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BRIEFLY TOLD.

OBITUARY, MR. JAMES FREEMAN ROGERS.—It is with unfeigned regret that we report the death, at his home in Jamaica Plain, Mass., on the afternoon of Saturday, December 18th, of Mr. James Freeman Rogers, who had been Engineer and Superintendent of the Jamaica Plain Gas Light Company for well over a third of a century. Deceased was born in Langdon, N. H., July 20th, 1832, and in his 18th year came to Boston, where he found employment as a clerk in a mercantile house. Not long afterwards an opportunity to enter the service of the Boston Gas Light Company presented itself, which he accepted, remaining with that corporation until shortly before the beginning of the war of the rebellion. He terminated his relations with the Boston Company so that he might revisit his home, in the hope that the change would benefit the health of his wife (he married his first wife, Miss Annie M. Harned, in Chelsea, Mass., October 30th, 1854), which hope, however, was vain, her death ensuing some time in 1860. On the outbreak of the war (to be precise, on November 4th, 1861) he enlisted in the Fifth New Hampshire regiment, serving actively at the front in that body, until October, 1862, his retirement from duty having been brought about by wounds received in the battle of Fair Oaks. He accepted the post of Engineer and Superintendent of the Jamaica Plain Gas Light Company, and there his faithful, competent, loyal service to the Company is matter of record that needs no elaboration at our hands. He was prominent in his affiliation with the bodies representative of the gas industry, having taken and maintained membership in the following Associations: The New England Association of Gas Engineers, August 25th, 1873; the American Gas Light Association, October 18th, 1876; the Guild of Gas Managers, February, 1881. He was a frequent attendant at the meetings of the named bodies, or until failing health made traveling more than ordinarily arduous. In 1872 he was appointed Chief Engineer of the Fire Department of West Roxbury, Mass., serving continuously till that place was annexed to Boston, when he was appointed Call District Chief for the Roxbury section of the greater city. He was Past Grand Master of Quineboquin Lodge, I. O. O. F., and was one of the founders of Daniel Hersey Lodge, of which he was also a Past Grand. Other society memberships held by him were: In Eliot Lodge, F. & A. M.; the Red Men; and Gettysburg Post, 191, G. A. R. His second wife (Mrs. Jennie N. Moody, to whom he was married April 30th, 1896) survives him, as does a daughter. The funeral services were held on Tuesday, Decemuber 21st, and prominent amongst the throng who gathered to pay the last tribute of love and respect to their dead associate and friend were many representatives of the New England gas fraternity. Deceased had spent practically his whole business life in the service of the Boston and the Jamaica Plain Companies, and by reason of that connection, together with his protracted term of service in the Boston Fire Department and his affiliation with the societies named, which connections were developed, fostered and bound through his genial, gracious disposition, he had a host of friends who will sadly miss him.

NOTES.—For the main facts in the above short sketch of the career of Mr. Rogers we are indebted to Mr. Charles F. Prichard, of Lynn, Mass. ——"Observer," writing under date of the 21st inst., says: The alter-

ations and extensions to the plant of the Beverly (Mass.) Gas Light Company have just been completed and put in operation. They consist of a new brick purifying house, with slate roof, containing, besides the purifiers, which were removed from the old building, a room, separated from the purifiers by a brick partition wall, to be used as a sponge or revivifying room; and two others, one used as a meter room, and the other as an office. The old purifying house has been divided into two rooms, in one of which the Davis & Farnum Manufacturing Company has installed a rotary exhauster of ample capacity, and in the other an air condenser and a multitubular water condenser. In the retort house an additional bench of 5's has been erected. The business detail of the building was looked after by the Manager, Mr. Rogers, while the execution of the detail has been in charge of Mr. Hassett, the Superintendent. The named gentlemen and the Company are to be congratulated on the good results produced.——Under date of the 16th inst., Mr. M. W. O'Brien, Secretary of the Detroit Gas Company, acting under the direction of the Board of Directors, issued the following notice: "Notice is hereby given that a special meeting of the stockholders of the Detroit Gas Company has been called, and will be held at the office of the Company in Detroit, Mich., on Monday, January 17, 1898, at 12 o'clock noon, standard time, for the purpose of considering and acting upon the question whether this Company shall sell all of its property, franchises, rights and privileges, upon terms to be decided upon at said meeting, to a new corporation proposed to be organized, and if such sale be determined upon, to authorize proper action in that behalf."——A correspondent at Kansas City, Mo., forwards the following, taken from the Kansas City *Star*, dated the 18th inst.: "J.W. Harvey, a collector for the Kansas City, Missouri, Gas Company, went to Charles Graham's meat market, 1334 Broadway, late yesterday afternoon to collect a gas bill. Graham promptly refused to pay the bill, because, he said, it was too large. He insinuated that the Gas Company was trying to make the public pay for air, which was forced into the gas pipes at the works and that the gas meters worked overtime. Harvey got very angry and said he would turn off the gas, and went down into the cellar to carry out his threat. Graham shoved him away from the meter, whereupon Harvey struck Graham on the nose with a monkey wrench." The story then goes on to say that Graham's father took part in the fracas, and, with a meat cleaver, brandished in true butcher fashion, chased Harvey out of the cellar to the street and into a drug store, where he held Harvey until the arrival of Officer Rolfers, who placed the collector under arrest. The prisoner was arraigned before Justice Hawthorne, charged with felonious assault; and there our information ends. Taking all the circumstances into account, it looks that the collector was the first one to suffer assault, but few will care to hold that he was justified in using a monkey wrench on his assailant. The whole miserable affair goes to show that "personality" counts for much in respect of the things that are done by a gas company's agents in the transaction of its business.——Extensive and much needed betterments are being made on the main offices of the Consolidated Gas Company, which are located in Branch No. 2, Irving Place and 15th street, New York. The first section of the work, which has to do with the office housing of the engineering staff, will be completed by January 1st, and the arrangements for the housing of the executives will be finished about April 1st. The changes will be worth whatever sum of money is expended on them.——It is reported that John Wilson, J. A. McGonigle and Fred. Harvey are anxious to form an opposition gas company for Leavenworth, Kansas. Of course, they propose to sell gas "at a price not to exceed $1 per 1,000 cubic feet." Leavenworth needs another gas company about in the same degree that it needs two city halls, for the existing Company is selling a good article of illuminating gas at the reasonable price of $1.50 on lighting account, and $1.25 for stove and power use. Again, the old Company is about to sensibly enlarge its plant.——The Town Board, of Cicero, Ills., has granted a 50-year franchise to the Citizens Gas and Electric Company, the projectors of which propose to manufacture gas under the Hall process. The maximum rate they may charge is 60 cents per 1,000 cubic feet. During the discussion of the matter in the Council the projectors urged the "fathers" to visit Kalamazoo, Mich., where they would be greatly impressed with the beauties and value of the aforesaid Hall process. It is regrettable that the "fathers" did not make the visit, for had they done so we feel quite safe in saying that no franchise to supply gas under the Hall system in Cicero would have been granted.——The authorities of New Haven, Coun., have awarded a contract for the partial public lighting of that place to the New Haven Gas Light Company. One of its clauses provides for the maintaining of not less than 200 Welsbach outdoor lamps, at the rate of $30 each per annum.

The Work of the Hydraulic Main and Condenser.

[By Mr. S. Carpenter, of East Ham, in *Journal of Gas Lighting*.]

I know that, in connection with what I am about to say on the work of the hydraulic main, objection may be raised by some to a wet main. But I shall not hold any controversy respecting the difference between the wet and the dry main. I am simply going to explain the working of the wet main, and what I found to be the best in my practical experience with it.

In the first place, the hydraulic main should not be less than 12 inches square in small works, and 18 or 20 inches square in large ones. As the gas issues from the dip pipes, it should have plenty of room to develop. Cramping the gas in the main interferes with its flow from the retorts. The main should be made of wrought iron, which is best on account of its freedom from breakage. There should be side plates, so that they can be taken off when cleaning out is required. The hydraulic main is a very peculiar apparatus to fit up so that it may work satisfactorily; and the writer hopes the hints here given, as the result of many years' experience, may be of service to young gas managers, as a preventive is in all cases better than a cure.

We will begin with a main 18 inches square and 20 feet long. This will take two beds of retorts set eight in a bed, 20 inches by 14 inches. The ascension and dip pipes should be 8 inches in diameter in the center of the main, and at the side there should be fixed a seal-regulating valve. There should also be a hole, the bottom of which should be ½ inch higher than the bottom of the dip pipes. There would then always be ½-inch seal. At the back of the main there should be a pipe connected to the seal valve, to take away the tar and gas. The valve can be regulated to whatever height of seal is required on the dip pipes. The gas and the surplus tar will pass over the seal into the pipe at the back, and they should flow on together to the inlet of the condensers.

In practical experience the writer has found the wet main to be the best, in several ways. In the first place, it acts as a water valve and prevents the gas from returning down the ascension pipes when the retorts are open. Secondly, by having 1½ inches of tar for the seal of the dip pipes, the gas has to pass through the tar seal. To a certain extent tar is a purifying agent. At the same time, if its—the hydrocarbons or similarly constituted substances—ingredients did not combine and adhere, the perfect purification of coal gas would be almost an impossibility. When the gas is bubbling through the tar, it loses its smoky color; besides which there are sulphureted hydrogen and bisulphide of carbon, and many other impurities—too many to mention here—contained in the combination of hydrocarbon compounds called tar. So that the hydraulic main acts as a water valve, a condenser and a purifier. Hence we see the necessity for not separating gas and tar before the condensers are reached, for there they will separate of themselves.

It will be said that there is an accumulation of thick tar deposits at the bottom of the main. So there is; but this difficulty could be easily overcome by fitting up the main in the following manner: It should be 18 or 20 inches square, and made of wrought iron. The dip pipes should project through the top 12 inches, and in 20-inch mains there would be a clear 8 inches between the bottom of the mains and the ends of the dip pipes.

It may be convenient to describe here an apparatus for keeping the main clear of thick tar or other sediment, while it is in action; thus obviating the necessity for stopping gas making, opening the main, and drawing off the tar, as is usually done. The appliance consists of a screw shaft running the entire length of the main, through a stuffing box attached to the outside at one end of the main and to the inside at the other, and supported, where necessary and convenient, by intermediate bearings on the inside of the main. Upon the shaft work a number of shaped plates, called scrapers, each having a threaded hole into which the worm of the shaft works. On the shaft revolving, the scrapers will travel forward or backward in the direction of its length, whichever way the shaft is turned. The scrapers are of such a depth that there is considerable clearance between them and the bottom of the dip pipes. The shaft is placed at one side in the interior of the main; and the holes in the scrapers are at one end of them, not in the center, so that the shaft shall not turn directly under the bottom of the dip pipes. On the outside of the main at either end, or at the one most convenient, the shaft is furnished with a crank handle, by means of which it may be caused to revolve in any desired direction. The scrapers extend right across the main transversely, and travel on sliding bars fixed longitudinally on each side at the bottom of the main. They do not quite touch the bottom plate, but allow just a slight clearance to prevent friction. At intervals there are attached mud boxes, into which

the main opens, and the thick tar or other sediment is caused to fall into them by the scraper passing along and drawing it to the openings. The mud boxes are continued from below the main up the side to the same level at the top, but are distinct from the main, so that the tar or other liquid is at the same level as that in the boxes. The tops of the boxes are covered with plates which can be removed, and the thick sediment can thus be taken out at any time by scoops while gas is being made, without interfering with the seal of the dip pipes.

If the hydraulic main is fitted up in the manner described, there will not be any accumulation of thick tar or other sediment therein, and the number of stopped pipes will be greatly reduced—in fact, it will be almost a perfect main. If, however, it is not practical to employ the screw shaft, there is another way of keeping the main clear, which I will now describe. Cut a slot in the side of the main 18 inches long and about 4 inches deep; and let the bottom be 1-inch above the bottom of the dip pipes. Have a movable plate on the slot hole, so that it can be taken off whenever required for cleaning out the main. In the center of the main, at the bottom, there should be attached a mud box or pocket, fixed in open connection with the bottom of the main, and carried above the level of the tar therein, so that the tar inside and outside the main will be at the same level. The plates of the box can be easily removed without interfering with the seal of the tar in the main, and the box cleaned out when required—about once a month.

Before clearing the main, the seal valve should be shut and the plate on the side of the main taken off. A scraper attached to a long handle should be put into the hole, and then by drawing this forwards and backwards between the ends of the dip pipes and the bottom of the main, the thick tar or other sediment will be pushed into the mud box, whence it can be removed without interfering with the seal of the tar. By cleaning out the main in this way, the number of stopped ascension pipes will be reduced very much, and, of course, the make of gas per ton of coals carbonized will thereby be increased. With regard to stopped pipes, the writer tried for many years to find the cause of this trouble; and at last he discovered that the principal one was in the hydraulic main. He found that keeping the main clear of thick tar and sediment helped greatly to reduce the number of stoppages.

It will now be convenient to consider the work of the condenser—one of the most essential of the appliances used in gas manufacture; for it does more than condense the gas, it also serves to reduce its temperature to the degree most favorable for depositing its ammonia in the scrubber. In the writer's opinion, the tar in the condenser eliminates a portion of the sulphureted hydrogen and bisulphide of carbon, as these impurities are found in the tar.

The condenser may, without question, be regarded as part of the purifying plant. When the gas leaves the condenser, it has lost the smoky color by which we know that the apparatus has commenced the purifying process. The writer's experience with condensers is this: An apparatus consisting of a double row of pipes about 18 feet high; the size of the pipes being in accordance with the make of gas per hour. These pipes stand vertically on a cast iron box, having end plates bolted to flanges at either end, so that they can be taken off and the condenser cleaned out. The upper ends of the standpipes are connected to a box running the whole length of the vertical pipes. The upper box is partitioned off in opposition to the partition plates in the one at the bottom. This is the simplest and one of the best forms of apparatus for the slow condensation of gas. The gas coming from the outlet of the hydraulic main is, of course, conveyed to the condenser. Great care ought to be taken in cooling the gas before it enters this apparatus. Do not cool it too suddenly, and do not take the gas from the retort house into the atmospheric air. If possible, take it just under the surface of the retort house before it enters the condenser. Excessive condensation has its disadvantages, while insufficient condensation has also its evils. If the gas is gradually cooled, the writer is strongly of opinion that there will be little or no naphthaline either before the gas is purified or after it has undergone the process of purification.

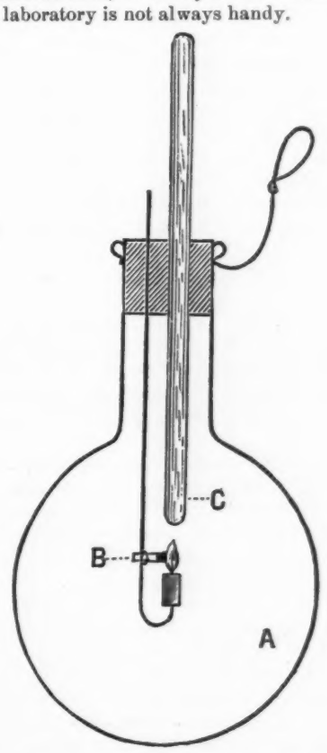
The writer prefers the vertical condenser for several reasons. By its use the gas can be cooled very gradually, and the temperature can be taken at several places; while by passing the gas up and down the pipes, the particles of falling tar come in contact with the stream of gas, and take up some of its impurities. The condenser, therefore, as already remarked, to a certain extent acts as a purifier. In the vertical condenser, the gas ascends one series of pipes and descends the other—the tar and ammoniacal liquor passing off at the bottom box. Connected to this box there should be a self acting siphon to take off the tar and liquor to the tar well; and at the inlet of the condenser there should be another to carry away as much of the tar and liquor as possible into the well before the gas passes into the condenser.

After the gas leaves the condenser it goes on to the exhauster. On its way there should, if possible, be two siphons. From the outlet of the condenser to the first siphon the main should drop 2 inches in 12 feet; and from the outlet of the siphon it should rise in the same degree until it reaches about half the distance between the two siphons, and then it should drop 2 inches in 12 feet until it comes to the second siphon, when it should rise to the inlet of the exhauster. In this way the tar will be drained off before the gas passes into the exhauster. If the hydraulic main and the condenser are worked in the way described, the gas will be well prepared for the scrubber. The object of the condenser is not only to cool the gas, but to reduce into ammoniacal liquor and tar the vapors intermixed with it as it issues from the hydraulic main, by which process the tar is, to a certain extent, prevented from passing forward to the other apparatus.

Before proceeding further, it may be well to briefly notice the impurities met with in the crude gas as it leaves the condenser. These impurities are ammonia (NH_3), carbonic acid (CO_2), sulphureted hydrogen (H_2S), and bisulphide of carbon (CS_2); and they cannot be avoided. Carbonic acid is always generated in the process of manufacturing coal gas simply because every description of coal contains oxygen; the sulphur and hydrogen which the coal contains combine and form sulphureted hydrogen, part of the carbon combined with the sulphur to form bisulphide of carbon, and the nitrogen unites with the hydrogen to form ammonia. It is absolutely necessary to remove these impurities, as they are not only useless but injurious if left in gas intended for illumination. This matter must, however, be left for another article.

How to Show the Effect of Burning a Candle in Air.

Mr. W. French, writing in *Chemical News*, says that he found the following experiment, showing the effect of burning a candle in air, to work extremely well; it possessing the further advantage of marked simplicity. It is a modification of an experiment well known, and figured in "Perkin and Lean," and dispenses with the use of a battery, which in a small laboratory is not always handy.



The round bottom flask, *A* (about 1 liter), is fitted with an indiarubber stopper through which passes an iron rod having a small candle attached. Just above the candle is wired a small "match end," *B*, so that the head nearly touches the wick of the candle. *C* is a greased glass rod passing easily through the stopper. The indiarubber stopper can be wired down. The whole apparatus is counterpoised. The lower portion of the glass rod is heated, the cork replaced and wired in; the glass rod is now momentarily pushed down until it touches the match, which readily ignites the candle. When the candle ceases to burn re-weigh,

The Bronder Improved Apparatus for Discharging Retorts.

On the 7th inst., U. S. Letters Patent (No. 595,039) were granted to Mr. Gaston A. Bronder, of New York, for improvements in machinery for discharging gas retorts. Using the words of the specification :

In machines heretofore used and now in use for discharging gas retorts—such, for example, as that described in my Letters Patent No. 447,022—the rakes are in part supported by a traveling carrier which runs forward and backward for the purpose of introducing the rakes into and withdrawing them from the retorts, and in part by a lifting bar arranged at a fixed distance from the front of the retorts. When the traveling carrier is in its most backward position, only about half the weight of the rake is supported on the lifting bar ; but as the carrier runs forward with the rakes to project them within the retort a greater portion of the weight of the rakes is brought upon the lifting bar. A weighted lever has been and is commonly applied to the lifting bar for the purpose of counterbalancing the said bar and that portion of the weight of the rakes which comes upon it ; but as such portion of the weight of the rakes varies in the movement back and forth, it is desirable that some compensation shall be provided for its variation.

One object of the present invention is to provide a simple means by which this compensation can be effected ; and to this end my invention consists in making the fulcrum of the said lever adjustable automatically according to the movement of the carrier and rakes.

Another object of the invention is to better control the backward and forward movements of the rake carrier and rakes ; and to this end my invention consists of an improvement in the hydraulic governor, by which the movement of the rake bar is checked toward the end of its travel in either direction.

Figure 1 of the accompanying drawings represents a side elevation of a retort discharging machine, embodying my invention and a vertical section of one retort of each of three tiers. Fig. 2 represents a plan view of the machine. Fig. 3 represents a transverse vertical section in the line 3 3 of Fig. 1, omitting rake carrier and rakes. Fig. 4 represents a side view of the rake lifting bar and its counterbalance, and of the means for automatically adjusting the fulcrum of the counterbalance lever. Fig. 5 represents a plan view of the hydraulic governor ; Fig. 6, a longitudinal vertical section of the said governor ; Fig. 7, a transverse vertical section in the line 7 7 of Fig 6 ; Fig. 8, a transverse vertical section in the line 8 8 of Fig. 6. Figs. 9 and 10 are side views of the upper part of the rake lifting bar, the counterbalance, and the means for automatically adjusting the fulcrum of the counterbalance lever, showing the fulcrum in different positions. Fig. 11 is a back view of the upper parts of the fulcrum adjusting devices shown in Figs. 9 and 10.

Similar letters of reference designate corresponding parts in all the figures.

A A^1 A^2 *a a a a*^{1} designate the main frame of the machine, *A* being the base or platform, having erected upon it two uprights A^1 A^2, which are connected by horizontal braces *a a a a*^{1}, the whole constituting a carriage mounted on wheels *B*, which run on tracks parallel with the front of the bench or stack of retorts *C C*, which are represented as in three tiers.

D is the rake carrier, furnished with rollers *b*, which run between horizontal guides constituted by two of the braces *a* of the main frame, the said carrier being moved back and forth to move the rakes forward into the retort and to withdraw them therefrom by its connection with an endless chain *c*, which is wound upon a rotary drum *e*, and runs on two pulleys *d*, at each end of the main frame. The pulleys *d d*, at the rear end of the frame, are shown in Fig. 1, but those at the front end are hidden by other parts of the machinery, and I have not thought it necessary to make any special representation of them, because the same systems of chains, drum and pulleys are common in gas retort discharging machines—for example, in the machine illustrated in the expired patent of A. D. Ross, No. 222,565. The shaft e^1 of the drum *e*, running in fixed bearings on the main frame, is furnished with a pinion e^3, gearing with a toothed rack e^2, connected with the cross head e^4 on the piston rod e^5. At one end of this rod is a piston working in a steam cylinder *f*, to and from opposite ends of which the induction and eduction of steam supplied from a boiler by a pipe J^1 are controlled by any suitable system of valves for the purpose of producing the movement of the rack. At the other end of the piston rod e^5, is a piston working in a hydraulic cylinder *g*, which constitutes the governor to control the longitudinal movement of the carriage back and forth produced by the winding of the chain *c* on the drum *e*, the rotary motion of which is produced by the action of the rack e^2 on the pinion e^3.

The carrier *D* and the rear ends of the bars *h* of the rakes *i* are provided with suitable connections which provide for the necessary upward and downward movement of the rake heads, and which provide for the detachment of such of the rakes as it may not be desired to operate and which are to be connected with the rear upright A^1 of the main frame.

E is the lifting bar for giving the rakes the upward and downward movement. This bar works vertically in guides *j j*^{1}, on the front upright A^2, of the main frame, and it is furnished with rollers *k k*, between which the rakes run back and forth and by which they are in part supported. The said bar is suspended from the shorter arm of a lever *F*, the longer arm of which carries a counterbalance *G*, for counterbalancing the weight of the lifting bar and the portion of the weight of the rakes which said bar sustains. The upward and downward movement of the lifting bar and the rakes is produced by means of two T-levers *l l*^{1}, pivoted to the main frame, the upper arm of each of the said levers being connected with the lower arm of the other one by means of two rods *m m*, the front arm of the forward lever l^1 being connected, by a link *n*, with the lifting bar and the rear arm of the rearward lever *l* being prolonged in the form of a handle *o*, by which an attendant on the machine raises and lowers the lifting bar.

The machine, so far as I have above described it, resembles retort discharging machines heretofore used and now in use, except that the fulcrum of its counterbalance lever *F*, instead of being fixed, is automatically adjustable to compensate in a greater or less degree for the variation in the weight of the rakes that is sustained by the lifting bar *E*, and for this purpose the said fulcrum consists of a pin *p*, which is supported in the upper arm of a lever *H*, which works on a fulcrum p^1, having a fixed position on the top of the front upright A^2 of the main frame or carriage. The lower and longer arm of this lever *H* is connected, as shown in Figs. 1, 2 and 4, by a rod *r*, with the crosshead e^4, so that as the rake carrier *D* and rakes are moved forward and a greater portion of the weight of the rakes is thrown upon the lifting bar *E* the fulcrum of the counterbalance lever is moved forward nearer to the lifting bar and farther from the counterbalance *G*, and the leverage of the counterbalance is increased, and as the rake carrier and rakes are moved backward and the weight of the lifting bar is diminished, the fulcrum pin *p* is moved backward, with the effect of diminishing the leverage of the counterbalance. This will be understood by reference to Figs. 9 and 10, which are on a larger scale than Figs. 1, 2, 3 and 4, Fig. 9 showing the position of the lever *H* and fulcrum pin *p*, when the rakes are in their most forward position, and Fig. 10 showing the position of the said lever and fulcrum pin when the rakes are in their most backward position, the rakes in both cases being supposed to be lifted.

To provide for the above-described shifting of the fulcrum pin of the counterbalance lever, the said lever is not pivoted directly to the said pin, but is suspended therefrom by means of two links *s s*, the upper ends of which are pivoted to the said pin and the lower ends of which are pivoted to the said lever by a pin p^*. To provide for the suspension of the counterbalance lever, the upper part of the lever *H* is made, as shown in Fig. 11, with a yoke H^*, through which the counterbalance lever *F* passes and within which the links *s s* work on each side of the latter level. To permit the counterbalance lever, and the links *s s* to work through the yoke H^*, the fulcrum p^1 of the lever *H* is made of two pins arranged in line with each other and secured one to each side of the yoke, and supported in two bearing blocks *t t*, affixed to the upright, A^2.

In order to provide for receiving the severe lateral thrust to which the lifting bar *E* is subjected, in the shifting of the fulcrum of the counterbalance lever by reason of the angularity of the fulcrum links *s*, the upper guide provided in the upright or front portion A^2 of the main frame of the machine is composed of two rollers, *j j*^{1} pivoted in said upright or portion of said frame, one in front and the other behind said bar. But for these rollers the lateral thrust above mentioned would be so severe that it would be difficult, if not impossible, for one man to raise the lifting bar and rakes.

Referring now to Figs. 5, 6, 7 and 8, which are on a larger scale than Figs. 1, 2, 3 and 4, it will be understood that the cylinder *g* of the hydraulic governor is counterbored at each end, as indicated at e^7, larger than the piston e^6, which works water-tight within the rest of the cylinder, and that there are in said cylinder, near each end thereof, three ports *u* u^1 u^2, which, opening into the passage *v*, running lengthwise of the cylinder outside thereof, form communication between the two portions of the cylinder on opposite sides of the piston. The ports *u* are in the counterbore e^7, and the ports u^1 u^2 are in the bore proper, to which the piston fits, but are at different distances from the heads of

Fig.1.

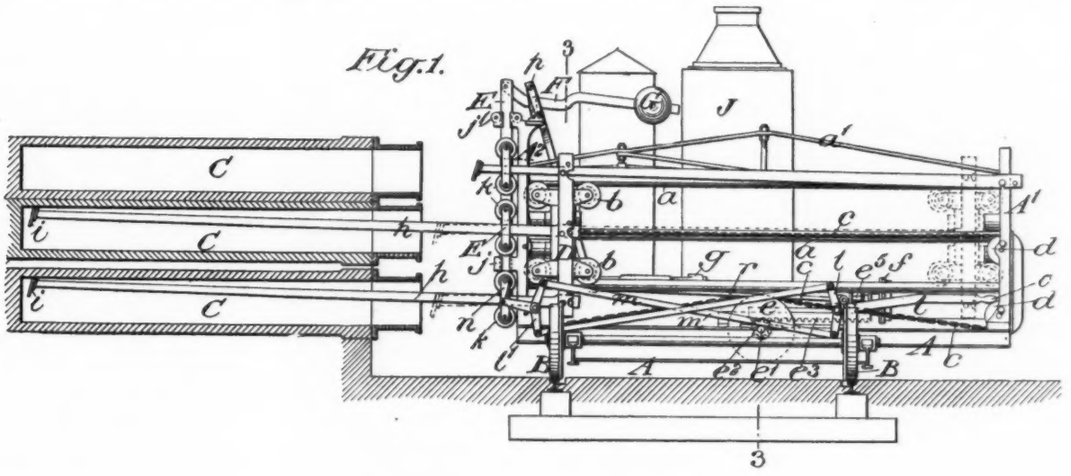


Fig.2.

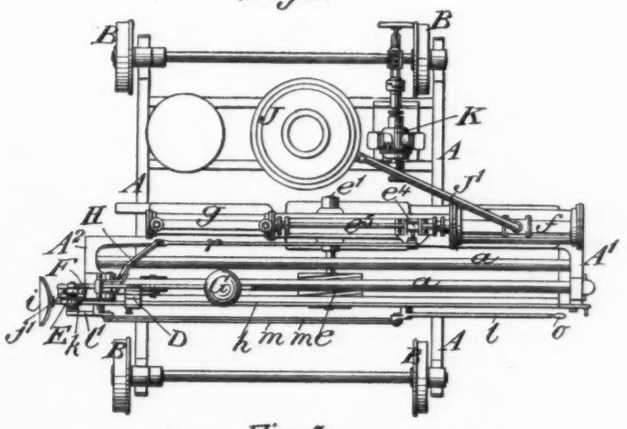


Fig.3.

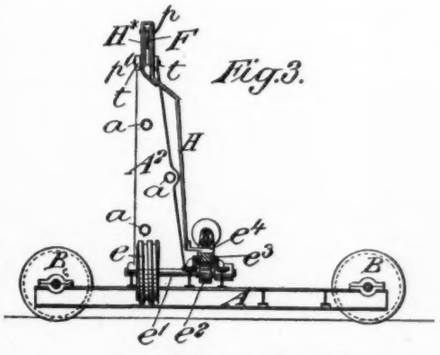


Fig.4.

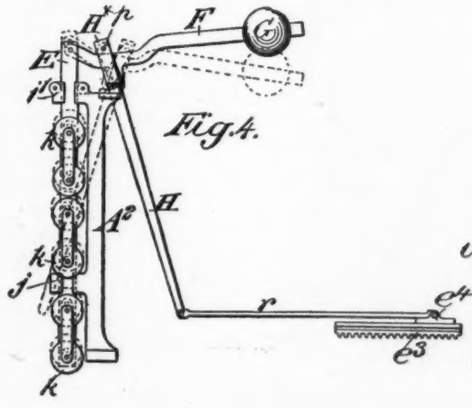


Fig.5.

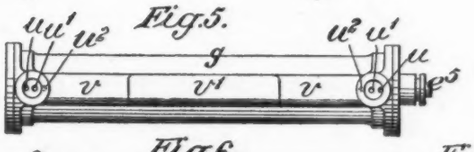


Fig.6.

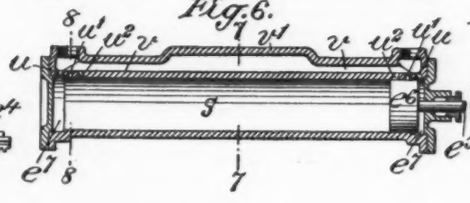


Fig.7.

Fig.8.

Fig.9.

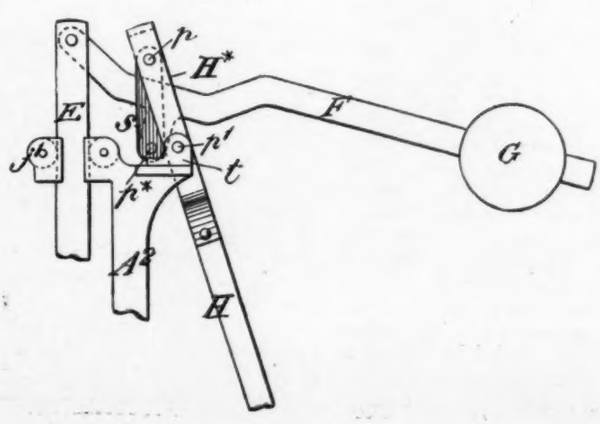
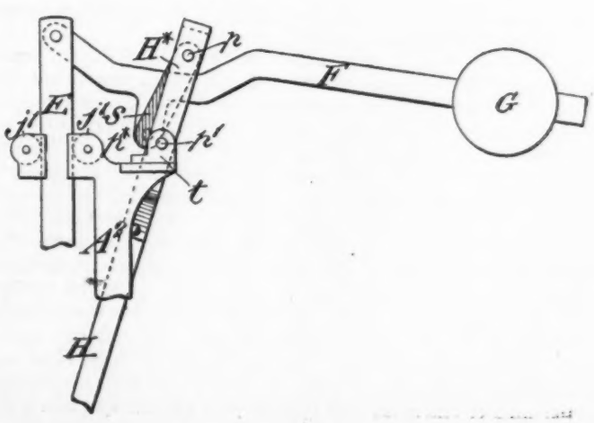
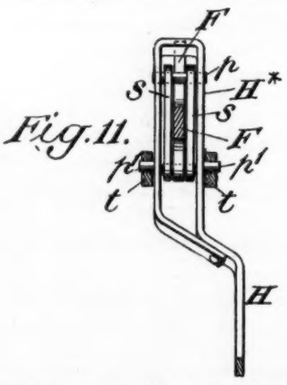


Fig.10.





the cylinder. The rakes can move forward or backward no faster than is permitted by the displacement of the water from one end of the cylinder to the other through the said passage and ports. As the piston approaches the ends of the cylinder it covers and closes the ports u^2 and u^1 one after the other, and so gradually diminishes the openings through which the water is displaced, consequently diminishing the speed at which the piston and the rake move as they approach the ends of their stroke in either direction, leaving the ports u in the counterbores always open, and thereby obviating any shock to the machine that might otherwise occur by the very sudden stoppage of the rake carrier and rakes. It may, however, be here mentioned that the ports at different distances from the ends of the cylinder might all be arranged in the bore proper, so that they would be all closed in rotation by the piston.

The high portion v^1 of the passage v between the ports $u\,u^1\,u^2$, having no vent, acts as an air chamber. The cubic capacity of the said higher portion or chamber is made somewhat greater than the cubic contents of that portion of the piston rod which is involved in the stroke of the said rod, so that while it contains some air it may also receive a quantity equal in volume to the displacement of the piston rod of the water, which, while the piston rod is passing into the one end of the cylinder, is forced out from the other end, where there is no rod, there being no room for this quantity of water in the portion of the cylinder occupied by the rod. Without this provision of this chamber v^1 or its equivalent the movement of the piston in one direction—viz., that in which the rod enters the cylinder—could not take place.

When, as is sometimes the case, only one tier of retorts is in use, and the use of only one rake necessary, it, in some cases, may not be necessary to shift the fulcrum of the counterbalance lever with the movement of the rake carrier and rakes, and in such cases the rod r may be disconnected by removing either the pin which connects it with the lower end of the lever H or that which connects it with the crosshead e^4, and the lower end of the said lever may then be made fast to any suitable part of the main frame or carriage; or for working one rake only the counterweight G can be adjusted to suit by moving it closer to the fulcrum.

K is a steam engine supplied with steam from the boiler J, and geared with one of the axles of the wheels B for the purpose of moving the entire machine along the front of the retort bench or stack to present the rakes opposite the several retorts in succession. This, however, is no part of the present invention. What I claim is:

1. In a machine for discharging gas retorts, the combination of a rake lifting bar and a counterbalance lever from which said bar is suspended and the fulcrum of which is movable with the rake, substantially as herein described.

2. The combination of a rake, a rake carrier, a rake lifting bar, a counterbalance lever from which said bar is suspended and the fulcrum of which is movable, mechanism for moving the said carrier toward and from the retorts, mechanism for moving the said fulcrum, and a connection between the carrier moving mechanism and fulcrum moving mechanism whereby the said two mechanisms operate together for the shifting of the said fulcrum with the backward and forward movement of the rake carrier, substantially as herein described.

3. The combination of a carriage, two or more rakes, a carrier for said rakes and means for moving said carrier backward and forward on said carriage, a lifting bar on said carriage common to the several rakes, a counterbalance lever from which said lifting bar is suspended and the fulcrum of which is movable, mechanism for moving the said fulcrum, means for connecting said rakes with the said carrier and carriage whereby one or more of them may be moved with the carrier while the other or others are held stationary on the carriage, and a detachable connection between the fulcrum-moving mechanism and the carrier-moving mechanism, all substantially as and for the purpose herein described.

4. The combination with the rake-lifting bar, the main frame or carriage and the counterbalance lever connected at one end with said bar, of a lever as H having its fulcrum on the main frame or carriage and carrying the fulcrum p of the counterbalance lever and the swinging links $s\,s$, by which the latter lever is connected with its fulcrum, substantially as herein described.

5. The combination of the rake-lifting bar, the main frame or carriage, the counterbalance lever connected at one end with said bar and having a movable fulcrum supported on said frame or carriage, and a guide for said bar consisting of rollers pivoted in the frame or carriage in front of and behind the said bar to receive the lateral thrust of said bar, substantially as herein described.

6. The combination with the rake carrier and the mechanism for moving the same, of a piston connected with said mechanism and a hydraulic cylinder in which said piston works and between the ends of which on opposite sides of the piston there is a passage with several ports at each end, the said cylinder being counterbored at each end, the several ports being at different distances from the cylinder heads, the ports nearest the cylinder heads being within the counterbore and the other ports being within the range of the piston to be successively closed thereby, substantially as herein described.

Exhaust Steam for Heating.

"Le Chat," in *Electrical Engineer*, says that steam heating by means of exhaust steam in conjunction with electric lighting, however economical when properly done, is more frequently than not the most expensive possible way to accomplish the end in view; this is to say, if the exhaust steam is forced through the heating system by the steam engine at the expense of a large percentage of the power of the engine itself, then we may conclude that the steam engine is employed as a heater, and as such it comes nearer to being a flat failure than does perpetual motion; because, while perpetual motion is impossible, at the same time it has one good point, viz., one must ultimately reach the end and stop the expense thereby. But the "rotary steam heater" (steam engine) being partially successful, becomes an everlasting expense.

To more clearly illustrate the point it may be assumed that a 12x12-inch engine at 300 revolutions per minute and 80 pounds per square inch initial steam pressure (one quarter cut-off) will indicate at a rate of 100 I.H.P. without back pressure (atmosphere excepted, condensation to the contrary), which engine will then be doing work with a view to furnishing power only. Now let us assume that the exhaust pipe be "corked up," thereby diverting the course of the exhaust steam into the heating system, thus causing a back pressure of, say, 12.2 pounds per square inch, or 25 per cent. of the mean effective pressure; or, in better language, 25 per cent. of the power of the engine is employed to pump the steam into the heating system. That is to say, in addition to the cost of generating 25 per cent. of all the steam for the purpose of heating 25 per cent. of all the power is required to pump it into the heating system, thereby straining the engine and the owner's pocket-book alike.

It might be said that this is a triple plated illustration, but in answer to this the writer begs to say that he has seen that amount of back pressure on more than one engine and upon one in particular within the last few days, notwithstanding the fact that "the sun still shines upon two sides of the street," so that it is impossible to conceive what will happen when "molasses commences to run slow."

It is also worthy of mention that some of these systems employ a "tea pot" for a feed water heater for fear that a little of the heat in the exhaust steam might be absorbed by the feed water before it is "pumped" into the steam heating system. In any case the plant above referred to had a little iron pot (which looked like a tea pot) securely strapped into position, to keep it from floating away no doubt, which some wag dubbed a "feed water boiler." As for the feed water itself, it reaches the boiler in its original package of shivers and causes the usual harvest of undue strain and overdue coal bills.

In short, in this instance to generate 120 amperes of current at 120 volts, or 19.3 E.H.P., required the undivided effort of 2,400 pounds of coal in ten hours, thus requiring 12.4 pounds of coal per E.H.P. hour, compensated for in a measure (*sic*) by the fact that steam heat was secured free of all expense (*sic*), the character of which being such as to make the radiators ashamed to look a yellow dog in the face, which, of course, they (the radiators) are never called upon to do, since no

yellow dog would go into the place and take the chances of being called upon to fill a vacancy in dog heaven, through the agency of an overdose of clammy atmosphere.

It is indeed a fact that many power users are possessed with the happy faculty of thinking that in this one instance, at least, they get something (steam heat) for nothing, while on the other hand the broad grin on the face of the coal merchant remains, like the fiddler's bow, unaccounted for.

The remedy for this disease probably is one of such a nature as will necessitate infusing into the systems of deluded power users a little "horse sense" and in the end, if power users can persuade themselves to believe that a tin can of some appropriate sort, applied to the tail of the dog, will produce a better result than the steam engine as a force pump, they will have gained in sense and cents equally. In any case it does seem ridiculous to use a steam engine in place of something better when heat instead of power is required.

The Condensation of Steam.

Engineering reports that at the last ordinary meeting of the British Institution of Civil Engineers (held on the last day of November), the paper that held the attention of the members was that by Messrs. Hugh L. Callendar and John T. Nicholson, who addressed themselves to the subject named in the heading. A fair abstract of the authors' compilation is appended :

In the discussion of steam engine trials it had generally been assumed that the rate of condensation of steam on a surface was practically infinite, so that any surface in direct contact with the steam was immediately heated to the saturation temperature corresponding with the pressure of the steam. It had also been supposed that the amount of condensation under any given conditions was limited, either by the resistance of the film of condensed water to the passage of heat, or by the capacity of the metal or of the circulating water to carry off the heat. In many cases condensation was diminished by films of oil or grease, or by accumulations of air, or by other incrustations or deposits, but these were not considered in the paper.

The authors found, on the contrary, as the result of their experiments on a steam engine running under normal conditions, that a practically clean and dry metal surface was not immediately heated to the temperature of the saturated steam in contact with it, that the rate of condensation of steam was not infinite, but finite and measurable, and that the amount of condensation in any given case was limited chiefly by this finite rate of condensation, and could be calculated in terms of it.

The cyclical variations of temperature in the metallic walls of the cylinder, with each stroke of the engine, were measured by means of thermo-couples inserted at various distances from the inner surface. It was possible thus to deduce the amount of heat absorbed and given out by the metal, and to infer the quantity of steam condensed and re-evaporated at different points of the stroke. The temperature cycles of the steam were simultaneously measured by a very sensitive platinum thermometer. The observations showed that the temperature of the steam in different parts of the cylinder differed in a systematic way from the saturation temperature as deduced from indicator diagrams.

In order to deduce the condensation from the observed temperature cycles, it was necessary to determine the conductivity and specific heat of cast iron. A series of experiments were made upon a 4-inch bar of cast iron, and the result found for the conductivity was nearly 30 per cent. smaller than that generally assumed.

At the lowest speed of the experiments, namely, 45 revolutions per minute, the temperature of the surface of the metal at the end of the admission period was found to be never raised higher than within 20° F. of the temperature of the steam, and the rate of condensation at any moment was simply proportional to the difference between the temperature of the steam and the surface. The numerical value found for the rate of condensation was 0.74 B.T.U. per second per square foot of surface per degree Fahrenheit of difference between the temperature of the steam and the surface. This was equivalent to the condensation of 27 pounds of steam per square foot per hour at 300° F. for a difference of temperature of 10° F. Assuming this law, the total amount of condensation at any point of the stroke could be inferred by measuring the "condensation areas" on the temperature cycle diagram—*i. e.*, the areas included between the curves representing the temperatures of the steam and of the metal surface.

To compare the results thus found with the missing steam deduced from the indicator diagrams and the feed measurements, the leakage of the valve and piston was determined as nearly as possible under the conditions of running. It was found to be proportional to the difference of pressure and nearly independent of the speed through a considerable range. The usual test for leakage with the valve stationary was found to be of little or no value. From a comparison of leakage tests, it was inferred that a valve in motion, however well fitted, was subject to leakage of a definite type. The leakage took place chiefly in the form of water, by condensation and re-evaporation on the moving surfaces, and was directly proportional to the perimeter of the ports and inversely to the width of the bearing surfaces. The amount of condensation observed during the admission period in a single-acting non condensing cylinder 10.5 inches in diameter with a stroke of 12 inches, was only 20 per cent. of the feed at a speed of 100 revolutions per minute. The smallness of this result was probably due to the early compression and the dryness of the steam supply. It was found that re-evaporation was completed very quickly, and that the walls were dry for the greater part of the cycle. It was inferred from the form of the temperature curves, and from other evidence, that the rate of re-evaporation was the same as that of condensation.

From the form of the law of condensation it was possible to make an important theoretical deduction with regard to cases in which re-evaporation was incomplete, and the walls remained wet throughout the whole cycle. Under these conditions the mean temperature of the walls should be the same as the time average of the temperature of the steam to which they were exposed, and the cyclical condensation was the maximum possible for the given steam cycle. If the extent of the clearance surfaces was known, this limiting value of the condensation in any case might be easily deduced from the indicator diagram. If the surfaces were dry during part of the stroke, the condensation was less than the limit, and it was necessary to know the mean temperature of the clearance surfaces in addition. Upon these views of the nature of condensation and leakage, the missing quantity of steam W in pounds per hour might be expressed by an equation of the general type, $W = S\,(t' - t°) + L\,(p' - p'')$, where the first term represented condensation and the second term leakage, S being the equivalent clearance surface in square feet, and $t' - t°$ the mean difference of temperature, in degrees Fahrenheit, between the walls and the steam during admission reduced to one-half cut-off. L, the rate of leakage per pound difference of pressure $p' - p''$, might be taken to vary approximately as the product of the diameter and the square root of the norn al piston speed, for engines of different sizes. It would appear from this formula that the effect of leakage on the performance was relatively more important in small engines and at high pressures, and that the loss due to condensation was most effectively reduced by increase of piston speed.

As an indirect verification of this law of condensation, the temperature of the clearance surface in cases in which water was present in the cylinder was measured, and was found to agree with that of the mean of the steam cycle. The amount of condensation was also correctly calculated in several cases of published tests in which sufficient data were available. The rate of condensation deduced was also directly verified by an entirely different method. The experiments gave approximately the same rate of condensation, and appeared to show that the water drops condensed on the metallic surface, owing probably to their rapid action, did not appreciably diminish the rate. Assuming it possible to estimate the condensation occurring in any given case by the method indicated, from a knowledge of the indicator diagram and of the temperature and area of the clearance surface, it then became possible to determine the amount of leakage under the actual conditions of running.

The First Safety Lamps for Mines, and Their Development and Improvement.

By Mr. William Clifford, in *Mining Engineer*.

The general use of safety lamps had a beneficial effect upon the production of coal. Numerous pits in whole districts, which had been abandoned for years, on account of the impossibility of working them from the danger of firedamp, were reopened ; and many of them continued to be productive collieries for more than 50 years afterwards, while a few of them are working to-day.

Davy's lamp was generally used in the coal mines of Belgium by the end of 1816, and colliery owners engaged in working fiery mines in England and elsewhere were well satisfied with it. Some of those, however, who were not aware of the cautions its inventor had given by demonstrations at Wallsend colliery, were unduly confident, not knowing that careful handling and keeping it out of strong currents were absolute conditions of its safety; and explosions did not entirely cease in coal mines after the introduction of the safety lamp.

Before quitting the subject of the Davy lamp, it may be stated that Davy's unutilized discoveries are of the greatest practical value; and only require the skillful mechanic and modern tools of precision to turn them to good account. For a full account of Davy's experiments the reader is referred to the transactions of the Royal Society of London, 1815, 1816 and 1817, which can be seen in the libraries of the Franklin and Smithsonian Institutes, and will well repay the few hours any mining student visiting Philadelphia, or Washington, may spend in pursuing them.

Thomas Bonner, of Monkwearmouth, County of Durham, England, was the first person to whom a patent for a miners' safety lamp was granted in Great Britain. It is dated December 4, 1827. I never heard of the lamp being used.

Upton and Roberts followed with a lamp that did not get into use in mines. It was nearly 40 years too soon and when tested in 1882 it was found equal to the best lamps, though this lamp as known to the writer, bears no identity with the patent of 1827, which is not for a miner's lamp but an ordinary lamp. Upton, who was a London lamp manufacturer, was unsparing in expense in endeavors to belittle the invention of Davy and in vituperating that great and unselfish man.

The Stephenson lamp, as we know it, was evolved out of the crude form of its invention and early use and the perforated copper cap added about 1854, and it is this improved form of lamp that is to be understood in all references as to experiments and behavior in connection with explosions in the Barnsley coal field.

In 1840 M. Mueseler first brought into use in Belgium the lamp that bears his name. The lamp of Mueseler was an immense stride, constructed on the lines determined by the inventor; this lamp, in an unbonneted condition, would not fire externally in an explosive current of over 20 feet per second. Slight modifications in dimensions, however, so seriously diminished its safety that the Belgian government prescribed the exact dimensions for lamps of this make used in fiery mines, and ultimately made the use of the Mueseler compulsory.

Only odd Mueselers found their way into Great Britain during the first 25 years after its invention, and a few were made by British lamp makers who did not understand the importance of adhering strictly to the inventor's dimensions. It must have been one of this style that was tested at Barnsley gas works just after the Lund Hill explosion in 1857, and found to fire sooner than a "Geordy" in a current of the same velocity. The introduction of the Mueseler lamp on a large scale into Great Britain was due to the traveler or agent of M. Achille le Grand, of Mons. The real object of this man's visit to England was to induce British mine operators to purchase Le Grand's patent combined iron railroad tie and chair, made by bending a piece of channel iron. Visiting collieries, this enterprising Belgian observed the kinds of safety lamps in use, and recommended the Mueseler to the notice of mine owners. The writer well remembers this man coming to Waleswood colliery in the spring of 1867 and writing the address of the Belgian lamp makers, Johannesberg Freres, in his note book. Unsuccessful with us, this traveler called at a neighboring colliery, where he persuaded the managing director, who had been at the school of mines at Mons, to order a few Belgian lamps. More followed. The same purchaser introduced them at Monkwood colliery, and recommended them to Strafford Main, where a short time after their introduction one of the greatest irruptions of gas ever known in the South Yorkshire coal field took place; 248 Mueseler lamps were put out by the presence of gas and in a very vigorous ventilating current in one long wall face. Had a single Davy or Stephenson been in use, an explosion must have occurred. But even with this serious object lesson before them, the English lamp makers continued to turn out Mueseler's in a happy-go-lucky sort of way; and if you will study the report of the British Royal Commission (final report 1886) on Mine Accidents, you will find a great variety of dimensions and of staying power in the Mueseler lamp tested.

In 1842 Geo. Roberts patented a sheet iron cylinder inside gauze of Davy. Half-a-dozen other people did the same thing during the next 50 years. Davy himself used this arrangement in experiments at Wallsend colliery, Sept. 9, 1816. The ultimate successful development of this form of lamp is due to M. Victor Fumat, of La Grand Combe colliery, France, in 1887. After firing two lamps, M. Fumat sent a third one, which the writer could not fire under the severest tests. In 1845 William Young used talc covers. At least six other people proposed to do the same afterwards, and patented their ideas.

In 1847 Benjamin Biram, who invented the anemometer and afterwards built the fans at Elsecar, so well known for the experiments upon them by Atkinson and Daglish, turned his attention to safety lamps.

In 1852 we have two other notable men bringing out safety lamps—M. T. Y. Hall, a noted mining engineer of North of England, and Mr. Herbert Mackworth, one of the mine inspectors in South Wales. Mr. Hall's lamp was ahead of our day, and Mr. Mackworth's lamps, when reinvented by Thomas Marshall in 1885, stood the highest test then applied to any lamp, and gave a good light. From 1852 invention went on apace, but nothing but mediocrity could get attention.

Between 1860 and 1875, in Great Britain, 12 lamps were invented, having for their object the extinction of the wick flame, by unscrewing the oil vessel. (One of these lamps, that of W. E. Teale, of the Protector Company, proved very successful.) Two for snuffless candles; 2 for the gas burning inside gauze bringing into action a shut-off (by burning or fusing fasteners); 1 hot air feed, T. Y. Hall; 1 enameled metal reflector; 3 air tubes through oil vessel; 1 electro-silvered gauze (not new); 1 water jacket between two glasses (E. B. Beaumont's); this idea was afterward adopted in an electric lamp by Miles Settle, of Darcy, Lever colliery, Lancashire; 1 for distributing fresh air in pipes to stationary lamps, and a number of miscellaneous devices. The name of the inventor of this system of distributing fresh air to fixed lamps was Cotterill. The year 1873 brought us the invention of the Bainbrigde. This lamp is the invention of Mr. Emerson Bainbridge, an English mining engineer of position and wide connections, and one of the Directors of the Hocking Valley Coal Company, and a member of the Coal Dust Commission in England. It is a Boty with long glass and short gauze. An illustration of the Bainbridge embellishes the cover of the transactions of the Society of British Mining Students. The writer has frequently seen the manager of a very large colliery light the gas in his office with this lamp, instead of using a match; and has carefully examined the lamp afterward, but could discover no evidence of tampering, or of enlarged inlet holes. This gentleman had 300 carefully packed away in a cupboard.

In 1874 the Williamson came into use. It was a distinct gain in point of safety. It was used at Aldwarke Main colliery in South Yorkshire for a number of years. In speaking of the Williamson, I am reminded of an occurrence that occurred some three years ago, which strongly impressed upon me the utter folly of using mixed lamps in fiery mines. I was inspecting the lamps at a colliery where 1,700 were in use on every day shift. They had formerly a number of Williamsons, and those remaining (6 in number) had been altered into Clannys by removing the inner glass. The strip of gauze remained over the inlet holes in the circular diaphragm; but I found that the two fork holes had been drilled through this diaphragm into the interior of this lamp and readily passed flame. So here, in a colliery subject to sudden outbursts of gas, six lamps no safer than a candle were taken daily into the very heart of the workings by drivers; and this had been going on for four years.

In 1879 William Purdy, a working collier of Eastwood, Nottingham, England, invented a lamp fed at the bottom like the Williamson, but instead of the gauze cylinder above the glass, it had an iron one covered with a gauze or perforated metal cap, like lamps of the Eloin type, and had a brass bonnet outside, with holes in the top to allow the products of combustion to escape. The inlet holes were well placed, and the light good and steady. It stood a high test by the Royal Commission. It was furnished with a simple pneumatic lock, and was probably the best lamp at the time of its invention.

Ashworth's Mueseler made its appearance about the same time as Purdy's lamps, or a year after. At that time Mr. Ashworth was employed as deputy manager at Garswood Hall colliery, and assisted Mr. William Smethurst in the lamp experiments made there previous to the work of the Royal Commission. He also took a part in the experiment work done by that body later on. Mr. Ashworth is the maker of the lamp known as the Hepplewhite-Gray. The Ashworth Mueseler, as to its interior, is pretty much the same as the official Belgian lamp in its lines, except that the gauze diaphragm is nearer the base of the chimney. Its peculiarity lies in its having two bonnets. The outer one is fast, and of the ordinary shape; the inner one is removable like the gauze, with its flange seated in the recess of the upper member of the cradle of the lamp. About an inch from the base of this inner bonnet are a number of holes to admit the feed air to the flame. Its upper end is a truncated cone terminating in the outlet hole three eighths of an inch in diameter for products of combustion, directly under the center of the cover of the outer bonnet. This is an excellent lamp. I could not fire it in a horizontal current of 100 feet per second, but fired it in a vertical one of from 60 to 70 feet after some two minutes' exposure. Mr. Herbert Hughes, in his book on coal mining, states that this lamp has successfully withstood an explosive current of 100 feet per second. This is, of course, only a half truth.

A few years ago in his inaugural address as president of the Society

of British Mining Students, Mr. Hughes called a special and commendatory notice to new features in Mr. Ashworth's Hepplewhite-Gray, viz., a long oval-sectioned tube or trunk had been substituted for one of the round tubes of Gray; and when I called Mr. Hughes' attention to the fact that this new feature was in M. Fumat's patent, and offered to send the French lamp for inspection, he did not reply. Mr. Ashworth had the loan of M. Fumat's lamp from me 12 months before. We now come to the period of the Royal Commission tests, and advent of the Marsaut lamp. This is one of the four specially commended in the report of that commission.

The Marsaut lamp, which the Royal Commission tested at a high velocity without explosion, had three gauzes, while those of which hundreds of thousands have been put into use in Great Britain and elsewhere, have only two gauzes. The odd gauze makes all the difference.

Mr. Marsaut is said to have made 12,000 tests with his lamp in all conceivable positions without exploding it. All I can say is, that he made his tests to little purpose. I can fire the 3-gauze Marsaut in an explosive mixture at a velocity due to 1 and ½-inch W. G. readily and regularly in under 30 seconds, the 2-gauze in the same test, in from 2 to 6 seconds.

I have seen Mr. C. E. Rhodes repeatedly fire the 2-gauze Marsaut at from 30 to 37 feet per second, according to the mixture used. The Royal Commission fired the 2-gauze Marsaut at 47 feet per second. (See Woolwich Arsenal experiment No. 671.) I never applied the commission test ("at an angle") or the vertical test to the Marsaut. Unlike the other three lamps commended by the Royal Commission, and several others, it would not bear the minor or horizontal test without firing externally.

Eight Marsaut lamps were presented to the Royal Commission for test. No. 7, the make in common use, was not tested at all. No. 2, the only 2-gauze lamp which appears to have been received from M. Marsaut, was only tested once, and then at the low velocity of 1,000 feet per minute, only for 30 seconds, and with 8 per cent. of gas. (Experiment 500, Woolwich series.)

Of the other three lamps especially commended by the Royal Commission, so often referred to, I would say that the bonnetted Mueseler has very great staying power, and with official Belgian internal dimensions, a high gauze ring and a large bonnet, it cannot be fired in any horizontal current which is regular in its flow, and with difficulty in a vertical current of the same character; but all Mueseler lamps have idiosyncracies, and in testing will sometimes fire when you do not expect them. They are peculiarly affected by eddying currents, and whenever you observe the wick flame of a Mueseler lamp flicker in a current, you may be assured that if that current were either inflammable or explosive the lamp would quickly fire. The same is generally true of all other lamps.

Evan Thomas No. 7, is a very strong lamp and can only be fired in a vertical test. You then must have an explosive mixture, and it must be steadily applied at a velocity due to 2 inches water gauge for two minutes.

Gray's lamp was only tested at 600 feet per minute in a down current, with "all out instantly." At the velocity of the horizontal test (3,200 feet per minute), it fires in an explosive down test in less than half a second, and at 1,500 feet in a few seconds. The Commissioners must have overlooked the peculiar weakness of this lamp in down currents, which is apparent from its construction, and has been proved by tests at reasonable velocities. The object of the Hepplewhite-Ashworth invention (Hepplewhite-Gray lamp) was to overcome this serious defect. The first safety lamp tests made by persons not engaged in devising lamps, were those by Dr. Pereiria, in the laboratory of the London University, in 1833 and 1835. His list was: Davy, Stephenson, Upton and Roberts, Dillon, Robson, Wood's Killingworth Refrigerator. Upton and Roberts came out first. The experiments were made at their expense.

About 1864 and 1865 Mr. James Wilson, late Manager of the Oaks Colliery, Barnsley, made experiments on safety lamps at Darfield Main Colliery, Yorkshire, and had a lecture table apparatus made for demonstrations in the school houses of the adjacent mining villages. The North of England Institute has made some low velocity tests suitable to the lamps of the time.

In 1878 Mr. William Smethurst, then one of the owners of the Garswood Hall Colliery, Lancashire, England, commenced to test lamps in a manner more nearly approaching underground conditions, and with larger current volume than had hitherto been attempted. Firedamp was piped from the Wigan 9-foot seam of coal which had been won but not opened out.

The Royal Commission on Mine Accidents afterwards used the same gas supply, and on the same apparatus made the first series of 271 experiments on November 2, 3, 4 and 5, 1880. The highest velocity in this series was 1,200 feet per minute. A second series, 185 experiments, were made in June, 1881. The velocities were the same as the first series, and the percentage of firedamp in the current in each case, 6.25, except in experiment 237.

The next experiments the Commission made were at Llwynypia Colliery, in South Wales. The total number of experiments made in the three series was 533. The maximum current was 1,000 feet per minute (mostly less), the maximum per cent. of gas was 13.5, the usual, 8.25. The inadequate supply of gas and the discovery of an error which rendered their percentages unreliable, decided the Commissioners to erect a high velocity apparatus at Woolwich arsenal, where the valuable aid of trained assistants from the Royal Laboratory would insure efficiency in working the apparatus and in observing results. Coal gas was used at Woolwich arsenal; but there the regularity with which it could be supplied to testing apparatus, the superior manipulation and equipment which previous experience had suggested to the Commissioners, and, not least, the higher velocity attained, made these Woolwich series of greater value than either the Lancashire or South Wales experiments made at collieries with firedamp.

The Royal Commissions' experiments, I am informed by gentlemen who were present on many occasions, notwithstanding the report of the Commissioners that 8 per cent. of coal gas gave a mixture violently explosive, were singularly lacking in detonating explosions, and in the uniformity of their mixtures. Those who are acquainted with the subject will bear me out when I say that perfect diffusion will not take place in the time occupied by a current in traveling 16 feet, when the velocity is 52 feet per second, without some artificial appliance or mixer.

At Aldwarke Main the column travels nearly 50 feet from the gas opening to the lamp under test. Hence, several lamps which the Commission failed to fire, were fired in the Aldwarke experiments by Mr. C. E. Rhodes at the Commission's velocity, a result which some persons who did not know of these differences were at the time led to question. I have frequently fired a lamp instantly (when it appeared that it would otherwise resist indefinitely), by applying the most explosive mixture at the same current velocity; and sometimes diminishing the current by slackening the air will produce the same result.

In the Woolwich apparatus the motive power of the column was produced by a Korting blower, the tap of which had an arc with the current velocities marked upon it. The gas supply passed through two meters of large size. The air measurements were made with a Biram anemometer.

Out of 763 experiments made, one only was with 10 per cent. of gas, or one of gas to 9 of air; 22 with 8.4 per cent. of gas, or one of gas to 10.94 of air; 740 with 8.0 per cent. of gas, or one of gas to 11.33 of air. I did not see this apparatus until it was partly dismantled. During the time the Commission were making experiments the British Home Society issued a circular through the Inspectors, calling attention to the failure of the Davy, the Stephenson and the Clanny at very low velocities; and South Yorkshire could not remain in uncertainty while the government tests dragged out their weary length through years.

The Midland Institute therefore decided to erect an apparatus of their own at the well known Aldwarke Main Collieries of John Brown & Co., so that long before the report of the Royal Commission was issued, the question of which was then the best safety lamp had been practically settled by Mr. Rhodes and his co-workers.

The time limit of the experiment with the Aldwarke testing apparatus was one minute with the most explosive mixture, at 51 feet per second of current velocity. Subsequently a larger gasholder was added; this allowed a duration of two minutes, other conditions being the same as before.

The Aldwarke apparatus, like the one at Woolwich, circulated its current by means of a steam nozzle, and the velocity was roughly checked at each experiment by a somewhat rudely made Dickinson anemometer. The relief doors were kept practically air-tight during an experiment by the excess of outside pressure, but were blown open by expansive force resulting from an explosion of gases within the test tube. The descending test was found to be the most severe. No tests at an angle, as made by the Royal Commission, were provided for and this is the most trying test to the Mueseler.

Early in 1886 the Royal Commission completed their tests, and the Midland Institute having satisfied itself of the status of the several lamps, interest flagged; but Mr. C. E. Rhodes still continued, as a matter of courtesy, to test lamps sent to him for that purpose. This, as I afterwards found out by experience, is very thankless business, bring-

ing no other reward than the ill-will and often the abuse of sanguine owners of exploded lamps.

But notwithstanding all that had been done, the question of which, among the dozen or so of good lamps, was the safest, and which of them would fire by prolonged exposure to tests already applied, remained unanswered. A new Mines' bill had been formulated—a most drastic measure.

The exclusive use of one lamp (the patents of which were owned by a powerful firm) was one of the unwritten clauses of the bill as it existed in the minds and intentions of certain parties. Of this I had no idea when I fired the favored lamp and proved it below the average; but my ignorance did not excuse me from abuse, nor did I wish it. Later it was endeavored to secure a like monopoly for an electric lamp, and it was stated in the newspapers that that delightfully proper and upright man, Mr. Henry Labouchere, M.P., the proprietor of the *Truth* newspaper, had been throwing my lamp about one of the committee rooms of the House of Commons, Westminster, in the interests of the electric lamp referred to. Professor Sylvanus Thompson, whose name had been mentioned in this connection, felt it his duty to repudiate any indorsement of this electric lamp in the scientific papers during the next few weeks.

Such were the kind of tactics which many speculators followed in their endeavors to make capital out of the feverish condition of the public mind, and such were the devious ways by which men sought to force upon the coal miners, lamps which would not bring additional safety, but might bring glory or gain to inventors or speculators. It was but a repetition of the early history of the safety lamp; men seeking to belittle the inventions of others, and all losing sight of the fact that, but for Sir Humphrey Davy's invention, theirs could have had no existence, as every invention connected with the safety lamp since Davy's is only of a secondary character.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Dec. 10th, 1897.

The Fire in London—Prof. Vivian B. Lewes on Acetylene—High Tide on the Thames—Large Electricity Supply Schemes.

The large fire which resulted in the destruction of some 500 warehouses, and devastated an area of four to five acres in the busiest part of the city of London, a week or two ago, was attended with unfortunate results so far as the gas and the water companies are concerned. The New River Company supplied some 15,000,000 gallons of water for the use of the Fire Brigade, for which they receive no payment whatever, as it is understood that they shall furnish water for extinction of fires whenever required. This is a public service that receives scant recognition, but the value of it is evident by the fact that 15,000,000 gallons, priced out at the modest rate of 6d. per 1,000, represents a sum of £375 sterling. The Gas Light and Coke Company, who supply the district covered by the disaster, stand to lose 149 meters, 60 gas stoves and a quantity of gas somewhere between one-half and three-quarters of a million cubic feet. Taking the magnitude of the conflagration into consideration, that quantity of gas is not unduly large, and it quite disposes of the assertions that have been freely made to the effect that the arrangements for stopping off the supply of gas from the burning district were defective, and that the fury of the flames was greatly increased by the escaping gas as a consequence. The flames spread with such unusual rapidity no doubt on account of the fact that the buildings were mostly stored with fancy goods, including large quantities of varnished paper and other active combustible matter, that in some cases it was difficult to get at the valves, or the heat had got there before, and so warped the appliance that it would not act, but beyond that, the gas supply was under perfect control, as shown by the fact that no less than 14 main valves were successively closed as occasion rendered necessary. As usual, a report has been set on foot that the origin of the fire was an explosion of gas, and this in face of the fact that the official reports state that the origin is not known. But it seems to be an article in the creed of the average penny-a-liner that the gas is the last resort, failing any other explanation. His news is wanted in a hurry, and there is always a disposition to fill up gaps in the narrative by plausible or popular opinions and speculations. A great deal of misapprehension appears to prevail as to the effect of gas in large conflagrations. The popular idea would be to get it cut off as soon as possible from outside; but the best authorities prefer that it should be left. The fire brigade officers have frequently requested that it should be left on, as the light blazing from two or three broken gas services is useful to them and of more importance than any slight addition to the materials that feed the flames. When a building is well on fire the addition of another torch or two is not a matter of consequence one way or the other. Another popular delusion is that the gas is in some way dangerous when a fire breaks out, and also that it is the cause of many conflagrations. Official statistics show that gas is safer, so far as fire is concerned, than electricity, oil or candles.

Prof. Vivian B. Lewes has been lecturing in his usual eloquent style upon his favorite subject of acetylene, at the London Institution, and has contrived to comprise, within the limits of a single discourse, as much practical information on the production of calcium carbide, the liberation of acetylene therefrom, the properties of the gas, and the best methods of consumption as would suffice to furnish material for a respectable tar book. Describing in detail the apparatus that has already been constructed and operated for the commercial manufacture of calcium carbide, he said that when working on the large scale, the production was 0.3 to 0.5 pound per electrical horse power per hour, and valued the cost of this amount of energy at £4 when obtained from water power in England. A good working mixture was 100 parts by weight of lime to 68 of carbon, 1.8 pounds of which would yield 1 pound of the carbide.

The exterior or crust of the ingot as it comes from the furnace is more or less impure, and about one fifth of the whole must be picked off and rejected before packing. So that in practice 0.5 pound of carbide from the furnace only yields 0.4 pound of salable material. It is absolutely necessary to pack the carbide in drums that are both air and water tight, as it decomposes slowly in moist air. Great care is necessary in the selection of the ingredients, as if phosphorus, sulphur or silica are present in any considerable quantity the resulting gas will be correspondingly impure, there will be some risk of spontaneous combustion, and the products of combustion will not only be deleterious to health, but destructive to furniture, draperies, etc. Speaking of the numerous appliances that have been devised for the liberation of acetylene, he expressed a strong preference for those in which the carbide is allowed to fall in small portions into a comparatively large bulk of water. Theoretically a pound of carbide should yield 5.8 cubic feet of acetylene gas, but in practice it could not be guaranteed to give off more than 5 cubic feet. Referring to the fact that acetylene is an endothermic body and similar in that respect to powerful explosives, he claimed that at ordinary pressures acetylene was as safe as coal gas, and it was only at high pressures that it became an active source of danger. The Home Office had very properly decided to place high pressure and liquid acetylene under the Explosive Acts, and he wondered there had not been many more accidents with it. Much difficulty had arisen in finding a burner that would consume acetylene without the nuisance of smoking. Many burners sold for the purpose soon clogged and evolved smoke. But the difficulty had been thoroughly solved by Mr. Naphey, of New York, and by Mr. Walmsley, of Chicago. For railway carriage and tramcar lighting, he believed, that diluted acetylene would prove more valuable than the pure material. Dilution had the effect of reducing the explosive properties, and a 30 per cent. mixture could be safely compressed in the usual way. As the usual diluents reduced the illuminating value to an enormous extent, he had made a long and exhaustive series of experiments with a view of finding a suitable diluent, and had discovered that if 30 per cent. of methane was present, hydrogen, carbonic oxide or water gas could be used. A mixture of 10 per cent. of acetylene made under these conditions would be a 20-candle gas that was perfectly safe, and it would compete in cost with coal gas on the small scale. Taking carbide at £10 per ton, he estimated that this mixture would be sold for about 3s. 6d. per 1,000 cubic feet, and was inclined to think that in this direction acetylene would offer the largest scope for speculative industry.

Prof. Lewes may be congratulated on giving warning as to the relationship of acetylene in a chemical sense to explosives, which of itself is sufficient to make practical men hesitate before having much to do with the gas, especially in view of the fact that the cheapness of the generating apparatus, the simplicity of the process and the beauty of the light produced, are attracting public attention to acetylene, irrespective of the ugly feature of the cost of carbide. This lighter feature also exercises a determining influence on diluted acetylene. I have not heard that it can be obtained for £10 per ton—only very lately the price was put at four times that amount—but calculating on that factor acetylene would cost about £1 per 1,000 cubic feet, and therefore 2s. 6d. out of the 3s. 6d. would be required to pay for the 100 cubic feet of acetylene in the gas, leaving only 1s. 6d. to pay for the generation and purification of the diluent, the storage and distribution of the whole, the

establishment charges and interest on the capital invested. Assuming that it was desired to provide a suitable enricher for a blue gas, so as to produce a 20-candle article, there are several cheaper methods, involving the use of oils or cannel, than acetylene at £1 per 1,000 cubic feet.

The London people barely had time to recover from the excitement caused by the great fire, when they were further disturbed by an unusually high tide in the river Thames, the water actually rising sufficiently to overflow into the streets, and threatening to wash the steamboat landing piers into the roadways. This was due to a heavy gale, and the whole district between London and the mouth of the river suffered greatly. Piers and embankments were destroyed, and large tracts of low-lying country submerged, in some instances to a depth of several feet. The damage to property was very great, and gas works did not escape. At Rochester the gas works are situated on the banks of the Medway, a tributary to the Thames, and protected by a wall. On the afternoon of Monday, the 29th ult., 60 feet or so of the wall gave way, and a sudden inrush was the consequence, the water getting into the governor house and flooding three leading mains to the extent of a mile or so. This happened so suddenly that nothing could be done, but the staff were able to protect the manufacturing plant. A singular feature of the incident is that the governor house was flooded in a similar way 22 years ago, and it was then raised in level to a line well above that of all previously known floods. This fact shows that the tide was a record one at Rochester. On the Monday night the supply was blocked, but by the following evening a sufficient clearance was effected to afford a fairly good supply. At Felixstowe the gas works suffered more than at Rochester. The whole plant was covered to a depth of 18 inches, the furnaces were extinguished, there was a total failure of the gas supply, and the authorities were compelled to issue a notice to the effect that it could not be resumed for a few days The Harwich Gas Company also suffered some injury to their property The Beckton works of the Gas Light and Coke Company and the Greenwich station belonging to the South Metropolitan Gas Company are situated on the banks of the river, but fortunately are both well above high tide, and proved to be beyond the reach of the invading element The advantage of having a gas works on the low level is seriously discounted at times of flood.

The success of the elctric power works at Niagara has attracted attention here, and led to the proposal to establish electricity supply undertakings in the colliery districts. The source of power is to be steam, and the fuel used under the boilers will be slack and other cheap or refuse matter, large quantities of which are to be had for a very low price. One of these schemes proposes to establish a generating works in the Nottingham colliery district, and to supply over a radius of 25 miles in each direction, the area covered being a thickly populated district, including several large towns and centers of industry. It is not proposed to compete with existing undertakings, but to supply them wholesale at a price below that at which they can manufacture for themselves. A second scheme, on a more modest scale, proposes to take the industrial centers of South Staffordshire. A central station, having a capacity of 6,000 to 10,000 horse power, is to be erected, and to supply within a radius of about six miles. As in the former case, it is proposed to secure the goodwill, and operate in conjunction with existing undertakings, and this company also proposes to let electric motors on hire. The promoters appear to consider that the machinery available for producing power in the day will also be available for light at night. But this is a delusion. Users of power will not expect to work for only six hours a day, during the months of December and January. On the contrary, it is a busy season of the year, and many of them will require full power for more like 16 hours, entirely covering the full period of maximum lighting. All gas companies know well the impossibility of working such a convenient double-barreled arrangement in practice. Users of gas cookers expect to use them just when they want them, day or night, winter or summer. So with the gas engines. An attempt to tie them down to daylight hours would be regarded as a practical refusal to supply them at all.

Mr. Smith's Garbage Gas Process.

By TRAVELER.

It is pleasant to note, in this period of revival in various industries, that the manufacture of patent gas processes that will revolutionize the business is not being neglected. Without the ever-humorous and startling alleged inventions of the patent process people the gas man's life would be dull indeed ; 1898 promises the usual harvest. In noting the first instance of the season that I ran across, last week, in Moline, Ills., I am filled, moreover, with a sense of pride that in conception, claims and revolutionizing power the inventions of the industrious gas process man easily rank with those in any other industry. That this is no mean task is evident when it is remembered that within a fortnight the ever-cheerful *inventors* of the daily press have assured us that a Boston syndicate is daily and commercially extracting gold from the waters of the sea ; that Mr. Brice, the Chicago alchemist, is transmitting antimony and dross into refined gold, through the medium of 5,000° volcanic furnaces ; that the sea serpent is appearing off Maine in *winter ;* that in both Milwaukee and Baltimore mechanical structures are crawling over the beds of the lakes and sea, recovering gold from lost wrecks ; and that the air ship, loose again, when last seen had just completed a 5,400-mile trip, etc. That gas is qualified to rank in such a galaxy of evidence of the world's technical progress is clear when it is also casually announced that a Mr. Chas. W. Smith has not only invented but has perfected a plan for *converting soft coal into a superior quality of anthracite*, in connection with the making of gas and bye-products. As the newspapers say, this is "important, if true ;" but when it is further stated that Mr. Smith's apparatus will also convert *garbage* into superior anthracite, incidentally also yielding gas and bye-products, it will be seen that the invention is simply marvellous, and that in one stroke it solves the triple municipal problems of light, heat, and garbage disposal. It is unfortunate that the newspaper dispatches do not give figures in decimals. However, those that are given easily show the commercial value of the process. One ton of bituminous coal duly converted yields 1,300 pounds, or 65 per cent. in weight, of anthracite, 300 pounds tar, 6,000 to 9,000 feet of good illuminating gas, ammonia, and some "etc." It is not claimed that it is necessary to use gas coal. As fair soft coal can be bought throughout the United States at from $1 to $4 per ton, according to locality, and as anthracite sells usually at 50 to 100 per cent. more, the value of Mr. Smith's process of conversion is quite apparent, even from the limited standpoint of the coal trade alone, irrespective of the returns from gas, tar and "etc." It is too bad that Mr. Smith does not tell us how he accomplishes his results. I can only infer that his process is along the lines of destructive distillation. But the details of how he manages that the resulting usual porous coke should appear as a dense and heavy anthracite would be more than interesting.

It is the gas-from-garbage idea, however, that especially attracts me. Has a new material for gas making purposes been pointed out to hitherto dense observers? Coal and oil are prosy and expensive. Garbage is novel, cheap and omnipresent. Why not use it? And at the idea, vistas of possibilities of the highest interest arise. Instead of coal sheds gas companies of the future will, perhaps, have vast tanks to receive the cities' garbage. It is true that the neighbors and board of health may object to such material stored in bulk, and that the odors of tar and oil of the past would be subordinated to or lost in those of slop, but details do not stop real progress; and many tastes are but acquired ones after all ! In time, no doubt, the storage question would be solved by double pipe lines throughout the city. Through one set—the larger—the gas company would exhaust or suck garbage from every household which, "converted" at the works, would be returned as gas through the other.

Suitable garbage receiving meters would replace present unaesthetic backyard cans, and would duly credit the consumer on his gas bill. If upon the slot principle, they would doubtless be connected with the gas meter alongside and would be operated with one pailful of garbage, instead of one coin. It is obvious that garbage from the brownstone front and terrapin districts would be richer and more valuable for gas making purposes than cabbage garbage from the slums, and, in the fullest equity, a householder ought to have delivered to him only the gas made from his own garbage ; but as gas from terrapin, turkey and truffles would be too rich and make unequal qualities in the different city districts, and also, no doubt, have an undue tendency to burner stoppages and smoking, it would, surely, be better to have such diluted by cabbage gas at the works, and only an average gas delivered to the city.

Gas from garbage would remove much trouble now present from coal mine strikes. As long as the people of a city ate, it would be producing its own gas making material supply ; truly, an ideal condition. However, irregularities would occur, such as overproduction at Christmas time. No doubt a brokerage system would be built up of outside supply tank car shipments from other points. This would be an advantage, as garbage from various points would vary, as does coal, and would, therefore, enable the selection and purchase of any grade desired. For instance, New York, Boston and San Francisco "Tender-

loin," "Back Bay" and "West End" garbage would, no doubt, command a premium for richness as well as quantity of the gas yielded. Garbage during the watermelon season would decline in price, owing to the percentage of weight lost in watery vapor during distillation. Garbage from almshouses and prisons would be almost valueless. Garbage from the corn belts of Kansas would probably be desirable for the clear, yellow tone of the resulting gas. A very obvious and convenient source of supply, for works fortunate enough to be located upon them, would be the Gowanus canal of Brooklyn, the Chicago river, etc., the same being said to be largely liquid garbage. With the new gas making material and such varied sources of supply, it is obvious that new statutes would have to be passed defining the purity of garbage gas and the allowable percentage of onions, asparagus, etc., perceptible per 1,000 in the commercial product.

The skeptic who doubts the gas yielding value of garbage should remember that, after all, it is only a mixture of waste animal and vegetable matter, most of the ingredients of which contain distillable oil or carbons to a greater or less degree. It is true that hard tack and clam shells are probably not rich in volatile hydrocarbons; but, on the other hand, peanuts, sardines, bacon and other substances are rich in oils. Are not the entire cotton and linseed oil industries built upon vegetable growths, and the lard business upon hogs? Are not the young of some seabirds so fat that they burn as a lamp upon the insertion of a wick by Arctic region natives, thus indicating the richness of animal matter. If garbage be thoroughly macerated and then perfectly mixed, will there not be a certain vaporizable oil value to it per pound or ton—the average of all its ingredients—readily comparable with coal or other gas containing substances? And would it not then only require suitable gas garbage distilling apparatus, such as inventor Smith says he has, to enable the use of garbage for gas making?

In Moline, and in the police station (where for some mystic but unexplained reason the experiments were conducted), it is said that from 1 quart of garbage enough illuminating gas was distilled to run an ordinary burner for 2 hours, in addition to anthracite, tar and ammonia secured. Assuming 10 feet so produced and that Moline garbage averages 3 pounds to the quart, we find a yield of 3⅓ feet to the pound, comparable with 5 feet from the usual coal. This is manifestly not a superior showing; but when it is remembered that gas coal costs $2 to $6 per ton, and that garbage, given away, can doubtless be collected for 50c. to $1 per ton, may not the latter substance be the cheaper after all for gas making purposes?

I confess to a desire for further information. Mr. Smith's comprehensive and ambitious claims attract me. Some inventors couple up refrigeration schemes with gas making. Others make asphalt pavements as a side scheme. Others propose to manufacture phosphates or pyroligneous acid in connection with their gas—all minor enterprises. But Smith limits himself to no such narrow field. At one crack he manufactures anthracite, thus revolutionizing the coal trade; at the same time he disposes of the garbage question, and he makes enough gas incidentally to light the city's streets, and no doubt run the boilers of the water works, the electric station and the fire department—if alongside. Smith is further deep and clever in selecting garbage as his raw material. Beauharnais, of the past, choose potatoes for gas making; others have taken charcoal, others corn-cobs. Smith by taking garbage doubtless aims to cover pretty much all past material and all likely to be proposed, so that in the future, in some great patent litigation, he will be able no doubt to show priority in the use of almost any material that may be proposed if such is a likely component of slop. Some cities are born great, some acquire greatness, but Moline bids fair to have greatness thrust upon it, and to take rank with Maysville, Kalamazoo and other centers of patent process exploitation. Nature has taken some thousands of years to convert soft into hard coal, and in the semi-bituminous districts isn't done yet. If Moline will blaze the way to accomplishing it in a few hours, what greater glory can she ask? This alleged invention of Smith, after all, is only speeding up nature less than the "inventions" of some process men who rise superior to nature, or, at least, try to.

Gas men will admit the disposal of garbage by conversion into combustible gases, and if Mr. Smith will now show us that he can do that, and at the same time have a large anthracite residue and revenue, and tar and ammonia and such things, he is the man they are looking for. They are not proud. If garbage is "the stuff," they will hold their noses literally and swallow it metaphorically, as a gas making base.

There is one element in Smith's plan of action that stamps him as so different from the ordinary that I scarcely know what to next look for. He is said to be developing the matter alone, on his own comfortable resources, and *not* to be asking others to put money into it!

As stated, the season of 1898 is opening up well.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THERE are 22,006 gas lamps on the streets of Berlin, Germany. Of these, 11,483 are fitted with Welsbach burners, and it is said that in due time the entire system will be changed to the Welsbach plan. In further connection with this subject the *Gas World* notes that "The Liverpool (England) Lighting Committee made its first official inspection for the year of the street lighting of the city on Wednesday, December 8th. Before proceeding on their rounds, the members dined together, on the invitation of the Chairman, Councillor Petrie. In responding to the toast, 'Success to the Lighting Committee,' Mr. Petrie said that the total number of lamps of every class was 14,254 lighting 409½ miles of streets, 561 passages, and 1,350 courts. Of these 133 were electric lamps, lighting 3¾ miles of roads, and 1,593 incandescent gas lamps, lighting 32½ miles of road. The work of the year had included the fixing of 97 electric arc lamps, lighting 2½ miles of road, 1,194 double incandescent lamps, lighting 19¼ miles of road, 108 single incandescent lamps, lighting 1¾ miles of road, 181 ordinary lamps, lighting 7 miles of road, and the lighting of 248 passages and 6,244 back doors. It was prepared in 1898 to light an additional 27 miles of arteries of the city by means of 1,077 incandescent gas lamps in lieu of ordinary ones, and to fix lamps in 400 passages hitherto unlighted, in addition to lighting of new districts. The incandescent light had been a great success and they were greatly indebted to Mr. Bellamy, who had patented a very valuable lamp. While they intended to largely extend the incandescent lighting of the main thoroughfares, they did not contemplate increasing the electric lighting very much."

SOME sort of gas supply for West Winfield, N. Y., is contemplated. The officers of the Company (which we believe is to be known as the West Winfield Gas Company) are: President, H. H. Wheeler; Vice-President, J. H. Stephens; Secretary, Wm. E. Hiteman; Treasurer, Arthur C. Hackley.

THE authorities of Carlstadt and of Woodridge, N. J., have granted the ordinance asked for by the proprietors of the New York, Rutherford and Suburban Gas Company, of Rutherford, N. J., permitting them to supply gas in the districts named. Their application for a franchise to distribute gas in Hasbrouck Heights seems to be hung up temporarily, which non-compliance seems to be in line with reasons, for the "logical" concern to do business in Hasbrouck Heights undoubtedly is the Hackensack Company. The latter Company, however, appears to be more interested in increasing its electric lighting trade rather than in developing its gas trade.

THE net earnings of the Milwaukee (Wis.) Gas Company for November aggregated $52,514, or an increase of $3,976 over the earnings for the corresponding month in 1896. The total earnings for the 11 months ended Nov. 30 were $432,885, or $47,068 more than the net earnings for the same months in 1896.

THE Consumers Gas Company, of Reading, Pa., has opened a handsome and commodious showroom at No. 16 North 5th street. It covers the entire first floor of the Mutual Insurance Company's building, and will be used exclusively for the display of gas stoves, improved burners, etc. It adjoins the Company's main offices at 18 North 5th street. The showroom will be in charge of Mr. Theodore I. Keppelman.

THE property of the Norwalk (Ohio) Gas Company was recently sold at delinquent tax sale (the arrears covered a period of 6 years), the bidder in being Mr. Theodore Williams, who offered $1,220 for the claim.

MR. JOSEPH THOMAS CAREW has been elected a Director in the Cincinnati Gas Light and Coke Company, vice the late Mr. Charles Fleischman.

NEGOTIATIONS looking to the lease of the Paducah (Ky.) Gas Light Company are likely to be completed. The intending lessee is Mr. A. E. Einstein.

THE best information obtainable at the present time goes to show that those largest in interest and ownership of the Companies supplying illuminating gas in Pittsburg and Allegheny, Pa., have agreed to combine the several properties under their own dictation and planning. The companies agreeing to the merger are: The Pittsburg Gas Company, Allegheny Gas Company, South Side Gas Company, East End Gas Company and Consolidated Gas Company. Mr. D. Herbert Hostetter, the worthy son of a father (the late Dr. Hostetter) whose reputation for probity was national, is to be credited with convincing his

associates that if their property was worth so much to others it was worth at least as much to them. The understanding now is that the combined Company will be capitalized in $5,000,000, and that the gas supply will be carried on from a new works to be constructed on a site on the Monongahela river, which site is occupied by the plant of the old Pittsburg Gas Company. So, after all, Mr. John H. McElroy, Engineer-in-Chief of the Pittsburg Gas Company, will likely direct the construction of a works that will for years stand as a monument to his honesty, knowledge, skill and patience.

THE proprietors of the Adams (Mass.) Gas Light Company have arranged for an important extension of the main system, to be carried out early in 1898. The scheme calls for the placing of perhaps 2½ miles of pipe.

THE Newark (N. J.) Gas Company has announced a change in the selling rate. On and after January 1st all gas used will be billed at the gross figure of $1.40 per 1,000 cubic feet, prompt payment, to entitle the user to a rebate of 20 cents per 1,000. The concession amounts to 10 cents per 1,000.

IN connection with other developments in the gas trade of Newark, the following, from the Newark *Call*, dated December 19th, will be of interest: "The organization of the Peoples Gas Company was announced during the week, and formal application was filed with the Board of Works for permission to lay pipes through the streets. The application was referred to the Street Committee. The Company guarantees to furnish gas for lighting purposes at $1 per 1,000 cubic feet. The incorporators are: Lewis Perrine, Trenton; Thomas C. Barr, John N. Robbins and William H. Smith, of Orange; H. Young, James E. Fleming, J. Newton Van Ness, Edward H. Duryee, Howard W. Hayes, George W. Wiedenmayer, J. Wilson Smith, Joseph M. Byrne and William B. Price, of Newark; and Maitland F. Griggs, of New York. The capital stock is $1,500,000, of which one-half is said to be subscribed. Mr. Thos. C. Barr, in speaking of the Company, said it was a *bona fide* concern, and proposed to deal fairly with the citizens of Newark, in spite of any and all rumors circulated to the contrary. He said that as soon as permission is obtained from the Board of Works, the Company is prepared to go ahead and complete its plant. Mr. Barr said he thought the work could be completed in a year. There might be some delays due to legal complications."

THE Peoples Gas Company, and Mr. Barr, and the others interested in its projection, may reasonably rest satisfied that the works will not be completed within a year, nor will they be supplying gas in Newark for several years, unless the Courts of New Jersey declare that contracts are of no consequence in that State. Our reason for so thinking can be found in the agreement entered into between the Newark Gas Light Company and the Newark authorities, March 1, 1893, which agreement took effect April 1, 1893, and which terminates April 1, 1903. Section 14 of that agreement declares: "In consideration of the prices named in this contract for furnishing gas for lighting the public streets and buildings of the city and private consumers, the city shall not grant to any person or corporation, other than those now furnishing gas in the city, the right to open or use the streets of the city for distributing gas, except under contract and requirements to lay pipes in all the streets in which pipes are now laid of equal size, length and capacity, and to furnish gas of the quality required by an act of the Legislature of 1875.

ALDERMAN AKINS, of the Denver (Col.) Council, is on record as asserting that in a short time another application will be made for an opposition gas franchise for that city, which application will, he guarantees, have no backing from those "interested in the old steam heating plant." What a concession! and what an assurance!

MR. E. S. FIELDING is informed that the executive management of the Bakersfield (Cal.) Gas and Electric Light Company is: President, Mr. H. A. Jastro; Vice-President and Manager, Mr. L. P. St. Clair; Secretary, Mr. H. A. Blodget.

BY the explosion of the acetylene gas plant, located in the cellar of the Federal Building, Wilmington, Del., the man in charge of the elevator (John J. Cooper) was killed. The explosion, which occurred on the afternoon of December 16, is thus reported in the Wilmington *Morning News*: "* * * No damage was done to the building except to blacken the walls, as the fire which followed the explosions was confined to the cellar. There were two explosions, and it was the first one that killed Cooper who was hit by the clamp cap of the hopper of the generator. * * * What caused the accident no one will ever know, but it was thought Cooper was charging the generator when the explosion took place. * * * Before the second explosion everything was bright in the cellar, although it was filled with smoke. One of the large feed pipes leading from the generator to one of the tanks seemed to be broken or leaking, as a big flame was issuing from the pipe. The second explosion did not seem to be so severe as the first one, but after it every light in the building went out. * * * It was not one of young Cooper's duties to take care of the gas plant — Engineer McIntyre has been attending to charging the plant for some time, although it is not one of his duties. Mr. McIntyre went home to his supper about 10 minutes before the accident, and asked Cooper to keep an eye on the tanks for him. He said he did not ask him to charge the tank, telling him there was enough in the tank to last until midnight. The direct cause of the accident will never be known, but from the condition in which things were found in the cellar it is believed that Cooper was in the act of putting the carbide of calcium into the generator. This theory is borne out from the fact that the clamp which he would have to take off to pour in the carbide was lying at the foot of the ladder which Cooper would have to mount to charge the machine. The theory advanced is that he neglected to turn off the cocks on the pipes leading from the generator to the tank, or reservoir, and the gas was forced back into the cellar, and it is thought it was ignited by one of the gas jets burning in the cellar nearby. The two tanks and the generator are located in about the center of the north-eastern part of the cellar. The tanks are of galvanized iron, and each has a capacity of 150 cubic feet." This plant was installed in the Federal Building, for the lighting thereof, some time ago, by the Carbide and Acetylene Company, the chief representatives of which in the Wilmington instance are Messrs. J. B. Whitehead and Emory S. Turner. The Federal Building is now lighted by gas from the mains of the Wilmington Gas Company.

ADVICES from Benton Harbor, Mich., under date of the 16th inst., are to the effect that Messrs. John W. Leggett, Oliver Goldsmith, Fremont Woodruff, William G. Goldsmith and George H. Paine, all of Detroit, have purchased the Excelsior Gas Company, which supplies gas to Benton Harbor, and which controls the franchise for the gas supply of St. Joseph, Michigan—the latter place is about 2 miles southwest of Benton Harbor. Mr. John R. Lynn has been appointed Superintendent of the Company, and it is likely that Mr. W. G. Goldsmith, who has been Assistant Secretary to Detroit Gas Company for some time, may take personal charge of the Excelsior Gas Company next spring. The connecting and distributing lines for the supply of gas in St. Joseph will be gone on with as soon as the frost is out of the ground.

THE Santa Ana (Cal.) Gas and Electric Company has closed down its electric lighting annex, in so far as the supply therefrom of incandescent service is concerned.

MR. BENJAMIN F. ARCHER, as President of the Camden (N. J.) Gas Light Company, recently issued the following notice: "At a recent meeting of the Board of Directors of the Camden Gas Light Company, it was unanimously directed to reduce the price of gas from $1.30, less 5 per cent., to $1 per 1,000 cubic feet, such reduction to go into effect on March 1, 1898, as to the northern section; April 1, 1898, as to the middle section; and May 1, 1898, as to the southern section of the city, which embraces all parts of the city. This reduction has been in contemplation for some time in accordance with the policy and past history of the Company, extending over a long period of years, by reason of which policy gas has been reduced in price from $4.20 to $1.30, less 5 per cent., as the city has increased in population and new processes have been invented and employed." Messrs. Archer, Watson and their associates are to be congratulated on this commonsense step, which will do more towards spiking the guns of the artillerists behind the proposed opposition Company for Camden than if regiments of lawyers had been pressed into service to bombard the courts with arguments of the verbose order.

THE Jackson and Woodin Manufacturing Company, of Berwick, Pa., is extending its foundry by an addition that practically covers an area equal to one-half of the space occupied by the original foundry. The construction of the new portion will be similar to that of the present building, having steel trusses supporting the roof and carrying trolleys for transporting material over the foundry floor. The contract for furnishing and erecting the steel work has been awarded to the Berlin Iron Bridge Company, of East Berlin, Conn.

THERE is talk of an opposition Company for Augusta, Ga. Our belief, however, is that the scheme or project will not get beyond the talking stage.

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MONDAY, DECEMBER 27, 1897.

Chemical Testing at Gas Works that May be Done by Non Chemists.

The *Gas World* reproduces the following abstract of an article on the subject named in the heading, which article was originally prepared for the *Journal für Gasbeleuchtung*, by Dr. F. Haber, of Carlsruhe, Germany:

In small works where no chemist is employed many points have to be referred to a chemical laboratory, such as the composition of a coal, an enriching material, a lubricating oil, a fresh purifying material; or the percentage of Prussian blue in spent oxide, and the like. The laboratory report is then sufficient for commercial purposes. These enquiries have, however, only to be made from time to time. It is of more importance to have the daily working kept regularly under control, and it is often impossible to engage a chemist for this purpose. The result of this generally is, that the control is in such cases neglected, or a consulting chemist is called in to advise when things have gone very far wrong. This is a disadvantageous way of acting; for while the great misfortunes are obvious enough, the small leakages and losses go undetected from year's end to year's end, and mount up to serious sums.

There are, however, several tests which can usefully be kept going even by one who is not a skilled chemist; for example, the amount of ash in the coal, or the amount of carbonic acid in the smoke gases. Every 1 per cent. of ash in the coal means a smaller yield of gas, and a lowered value in the coke, on account of diminished heating value and increased liability to slag. At the present time the whole make of ash free coke from washed coal is all taken up by the iron works; but it can hardly be doubted, with the rapid expansion of the coke industry, that very soon there will be plenty of ash free coke competing with gas coke. The proportion of ash in the coal should, therefore, always be kept down, by testing samples of every new delivery. Again, there is no greater source of continuous loss than bad firing—ill-regulated secondary air supply generally—so that the pyrometer and the Bunte burette should be in regular use. Every cubic foot of air which goes up the the chimney in excess of what is actually wanted represents a waste of heat, absorbed by it, and a useless cooling of the fire place. An excess of 35 cubic feet of air per minute correspond to the loss of 7 wagon loads of coal in a year, and the temperatures attained are depreciated. The greater the excess of air, the greater the loss of heat, and the lower the temperatures reached. It is no use to go round the benches with a chemist once a year, since the draughts vary from time to time. Mechanical appliances for regulating air are of no use if permanent reliance is to be laid upon them, though they are very useful in conjunction with regular testing of the smoke gases and their temperature. These tests have been carried on for some years under Professor Bunte, by engineering students, who have been found to take to them with great readiness.

There are, besides, these other tests, perhaps more purely of a chemical character, which may be carried on by sending samples to a chemist from time to time, or by the chemist sending in his apparatus, that the gas may be allowed to flow through it for a given time, and the apparatus then closed and returned to him that he may report on the changes undergone within it. But it is better to learn to carry on these tests regularly oneself, for it keeps the manager far better in touch with what is going on; and a periodical consultation with a chemist will then be of the greatest service, and can be expeditiously conducted, the necessary data being to such an extent already at hand. Practice will be required, of course; but the kind of thing is what is supplied by Professor Bunte at the Technical High School in Carlsruhe—an eight days' course of tuition in testing for gas managers. This course is carried on at the Carlsruhe gas works, through the co-operation of Herr Reichard, the Manager there. The scope of the work would include the estimation of carbonic acid and of sulphureted hydrogen in crude gas—both very simple, but very important—and the analysis of the coal, to see what sulphur might come forward in the gas, is, at any rate, of less importance than the testing of the gas to see what amount of sulphureted hydrogen actually is in it; for this indicates how the purification must be carried on. The more sulphureted hydrogen, the oftener must the purifiers be opened, the greater will be the loss of gas on opening the purifiers, and the smaller the quantity of cyanogen recovered in the spent oxide. Excess of carbonic acid, again, indicates that the coal is damp, or else that too much air is somehow getting into the retorts. As to the condensation, etc., the pressure and temperatures are generally recorded already. The working of the scrubber can be watched by noting the tar specks produced on paper in a jet of the gas before and behind the apparatus, say in one to two minutes; work more exact than this would be undertaken by a chemist.

The control of the ammonia in washing is also very important, and the sulphur in the purifying oxide shows whether the mass should be used over again or put aside as spent. Again, the manager should be able to tell whether his oxide is revivified sufficiently or not; in many cases it is used when the process of regeneration is still incomplete, to the waste both of gas and of labor. As to the gas itself, not only should its lighting value be ascertained, as is already regularly done, but its heating value should nowadays be regularly watched. It is not difficult to acquire the elementary knowledge of the chemical points involved in gasmaking; and with this elementary knowledge comes certainty in the conduct of the works, the inexplicable accidents fall off in number, and the working becomes more economical.

Rivet Holes.

In a paper read before the American Society of Civil Engineers respecting the working of soft steel for boilers, J. A. L. Waddell says: All structural metal work, whether it be medium steel, soft steel or even wrought iron, should be punched at least $\frac{1}{8}$ inch less than the diameter of the cold rivet and reamed to a diameter $\frac{1}{16}$ inch greater than same, and there is no bridge shop in existence which can turn out truly first-class work without sub-punching and reaming or drilling. Even when the greatest care is taken in punching the metal of the component pieces of long members, many of the rivet holes will fail to match by as much as $\frac{1}{8}$ inch, and the author has within a year or two seen $\frac{7}{8}$-inch rivet holes elongated to $1\frac{1}{4}$ inches merely to admit the rivets. Where several component pieces containing badly matched rivet holes are placed together and a tapered flexible reamer is used to enlarge the hole sufficiently to admit the rivet, the latter cannot possibly fill completely the irregular hole, and therefore, if left in the piece, cannot act effectively. If condemned by the inspector on account of looseness, and then driven out, it will, on account of its crookedness, materially injure the metal about the hole and thus weaken the structure, perhaps doing more damage thereto than would the leaving in of the loose rivet. The use of the tapered, flexibly connected reamer is all humbug, and is not true reaming at all, but merely a means of making it practicable to get the rivets through badly punched holes that assemble irregularly. Real reaming can only be done with rigid reamers or drills that remain at all times at right angles to the surface reamed, and cut a cylindrical instead of a tapered hole. Such reamers as these are the only ones that ought to be employed on first-class metal work, excepting, of course, in confined spaces where they cannot be used, and where the flexibly connected reamer must of necessity be employed.

The Market for Gas Securities.

The market for city gas shares, save in the instance of Standards, was fairly strong, Consolidated to-day (Friday) having sold up to 183½. The general belief in "inspired circles" is that the difficulties that were in the way of completing the New York and East River-Equitable-Amsterdam merger have been removed; further, others of the "inspired" agree that the general consolidation is at hand. Meanwhile the Consolidated triumvirate, who usually vote the proxies of confiding shareholders at the annual meeting, are experiencing less hearty responses to their solicitations than

heretofore. Mutual is 300 bid, and Equitable is 260 to 261. Anything on the city list looks to us a purchase, even the shares of Mr. Sage's Company.

Brooklyn Union is a trifle better than it was a week ago, and Peoples, of Chicago, is booming to-day, at 97⅝ to 97½. The least said about Bay Sta'e the better; the "ins" and "outs" having had quite sufficient to say about its affairs in the advertising columns of the daily newspapers. The weakness in Baltimore Consolidated continues, and Consumers, of Jersey City, is 77, bid.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

December 27.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	182	183¾
Central	500,000	50		..
" Scrip	220.000	..	100	.
Equitable	4,000,000	100	260	261
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	300	330
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150.000	50	..	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	70	71
Preferred	2,000,000	100	98	104
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106⅛
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	137	141
Preferred	5,000,000	100	148	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	117½	118
" " Bonds (5's)	15 000,000	1,000	113	114
Bay State	50,000,000	50	4⅛	4¼
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	98¼	97
2d " " "	3,000,000	1,000	..	88
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Company	25,000,000	100	97¼	97⅜
Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	91	94
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	77	..
" Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	206	207
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	51½	52⅛
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		55	57
" Con. Bonds	4,312,000	..	97	97½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	81	93
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	118	125
" Bonds, 6's	2 650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	86	88
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	44	44¼
Preferred	2,500,000	100	90	91
Bonds	9,084,400	1,000	103	103¼
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	124	130x
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97⅜	97½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	24	25
Bonds	1,000 000	..	94	97
Washington, D. C	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	83	85
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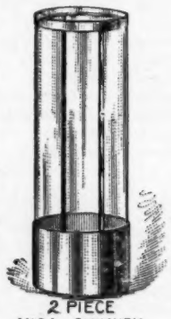
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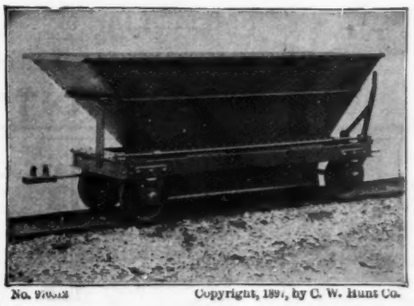

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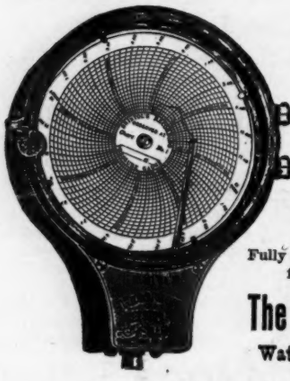

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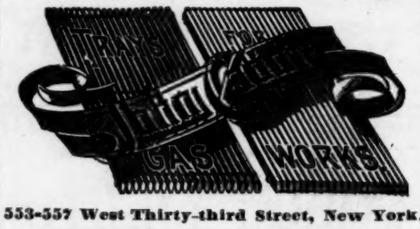

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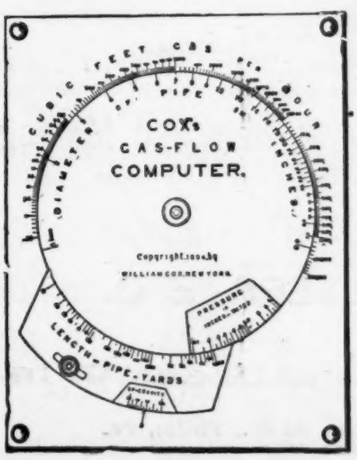

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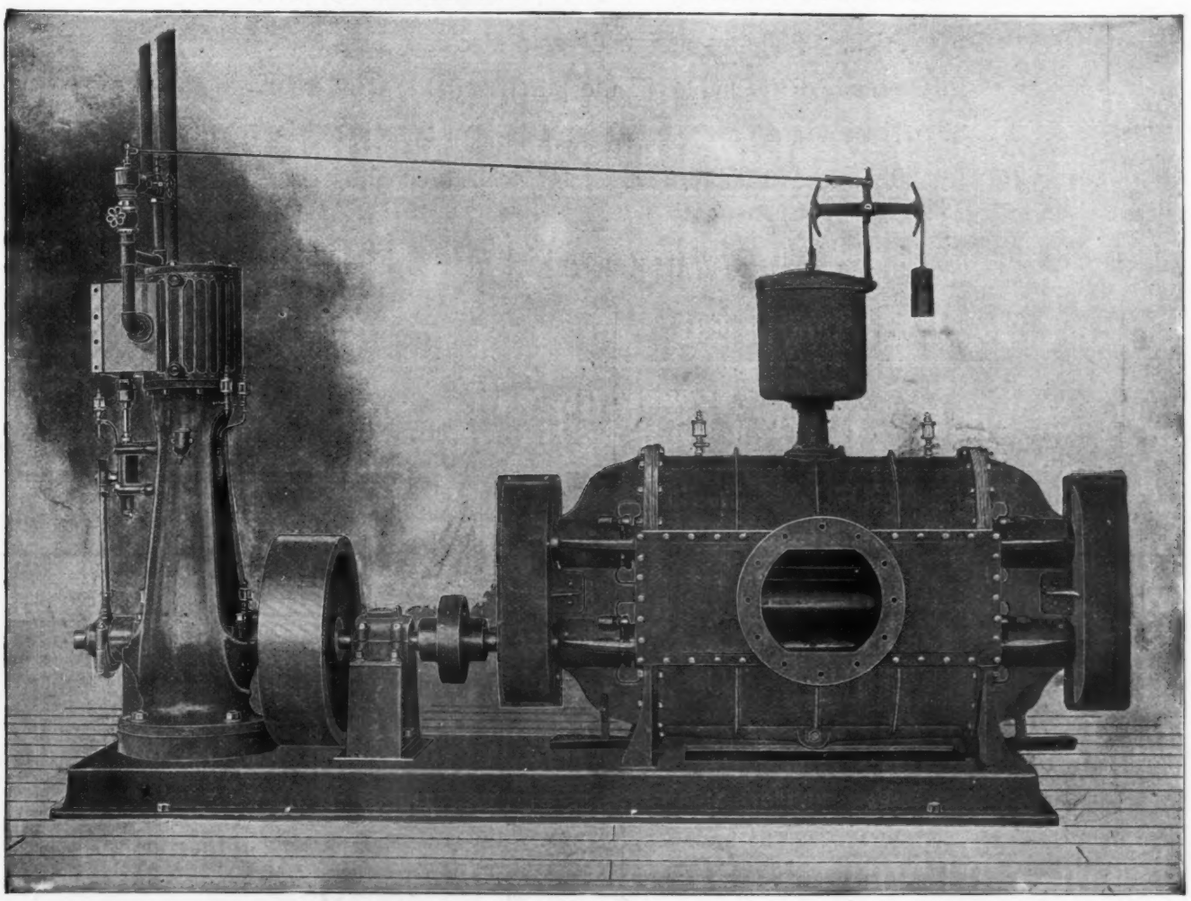

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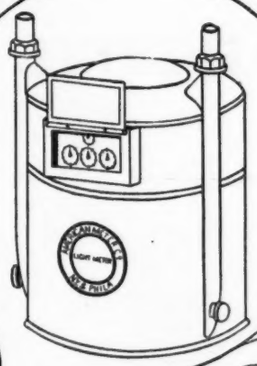
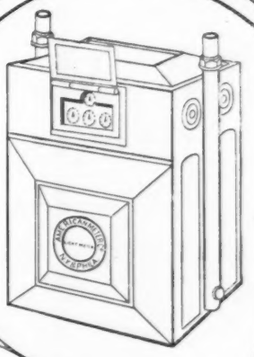
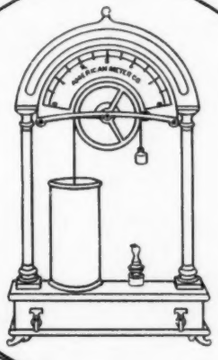


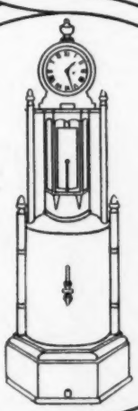


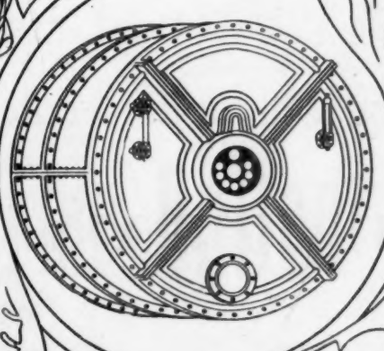


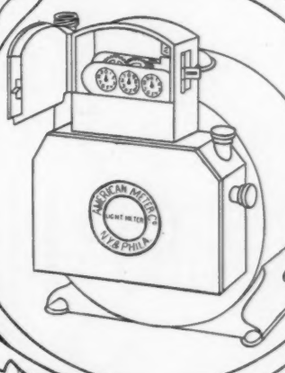
PUBLIC LIGHTING TABLE.

JANUARY, 1898.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. Extinguish.
				P.M.	A.M.
Sat.	1	1.50 AM	6.20 AM	4.30	6.30
Sun.	2	2.50	6.20	4.30	6.30
Mon.	3	3.40	6.20	4.30	6.30
Tue.	4	4.40	6.20	4.30	6.30
Wed.	5	5.30	6.20	4.30	6.30
Thu.	6	No L.	No L.	4.30	6.30
Fri.	7	No L. FM	No L.	4.30	6.30
Sat.	8	No L.	No L.	4.40	6.30
Sun.	9	5.30 PM	7.40 PM	4.40	6.30
Mon.	10	5.30	8.40	4.40	6.30
Tue.	11	5.30	9.50	4.40	6.30
Wed.	12	5.30	10.50	4.40	6.30
Thu.	13	5.30	12.00	4.40	6.30
Fri.	14	5.30	1.10 AM	4.40	6.30
Sat.	15	5.30 LQ	2.20	4.50	6.25
Sun.	16	5.30	3.30	4.50	6.25
Mon.	17	5.30	4.50	4.50	6.25
Tue.	18	5.30	6.20	4.50	6.25
Wed.	19	5.30	6.20	4.50	6.25
Thu.	20	5.30	6.20	4.50	6.25
Fri.	21	5.30 NM	6.20	4.50	6.25
Sat.	22	5.30	6.20	5.00	6.25
Sun.	23	5.40	6.10	5.00	6.25
Mon.	24	5.40	6.10	5.00	6.25
Tue.	25	5.40	6.10	5.00	6.25
Wed.	26	9.30	6.10	5.00	6.25
Thu.	27	10.30	6.10	5.00	6.25
Fri.	28	11.30	6.10	5.00	6.25
Sat.	29	12.40 AM FQ	6.10	5.05	6.15
Sun.	30	1.40	6.10	5.05	6.15
Mon.	31	2.40	6.10	5 05	6.15







TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45

To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

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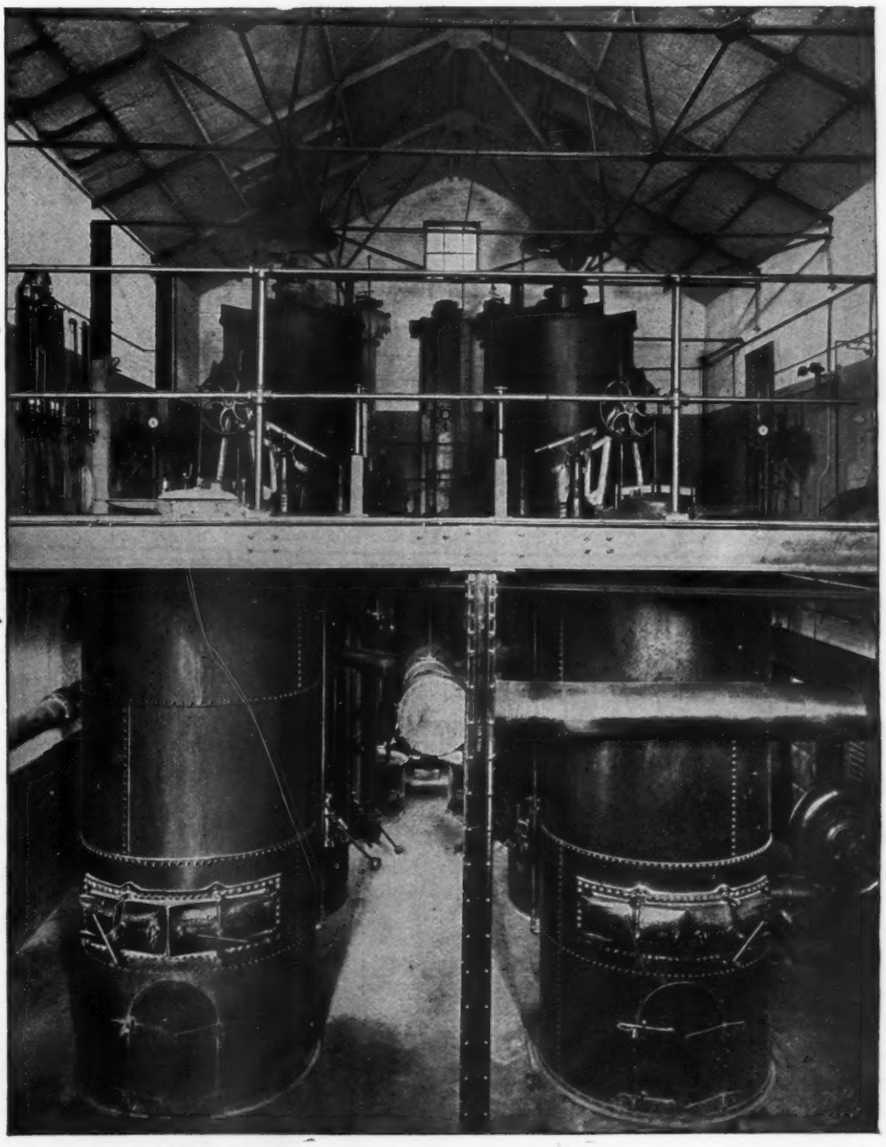

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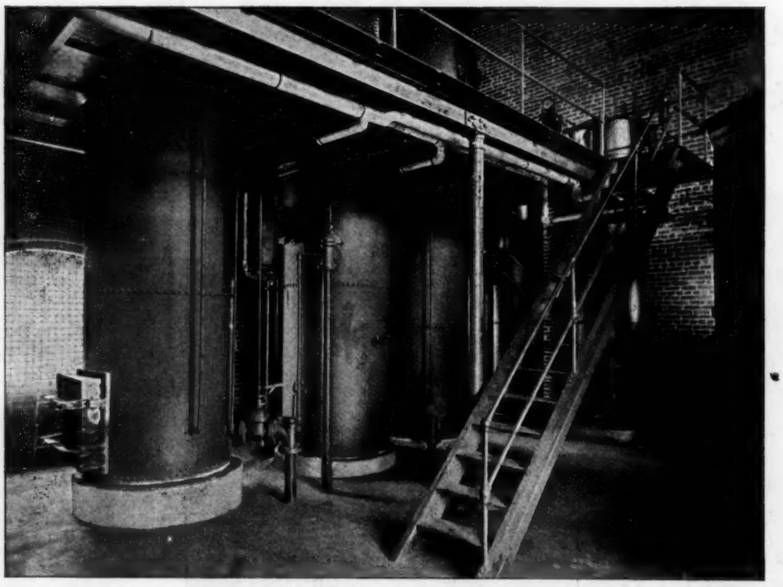

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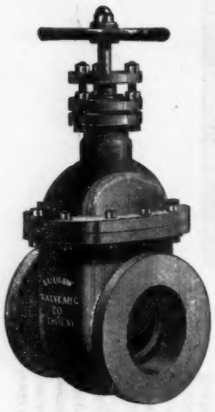

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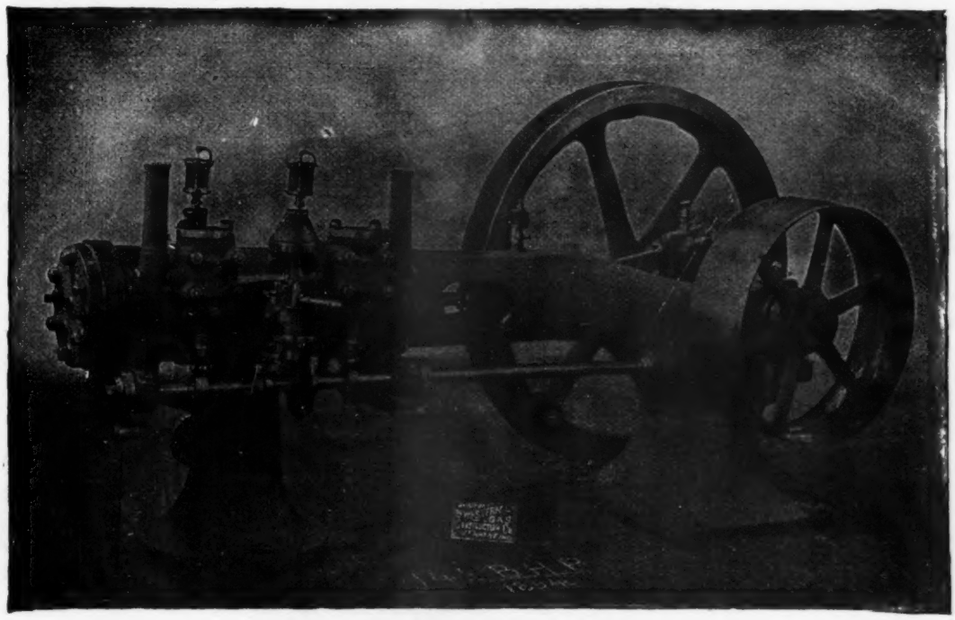

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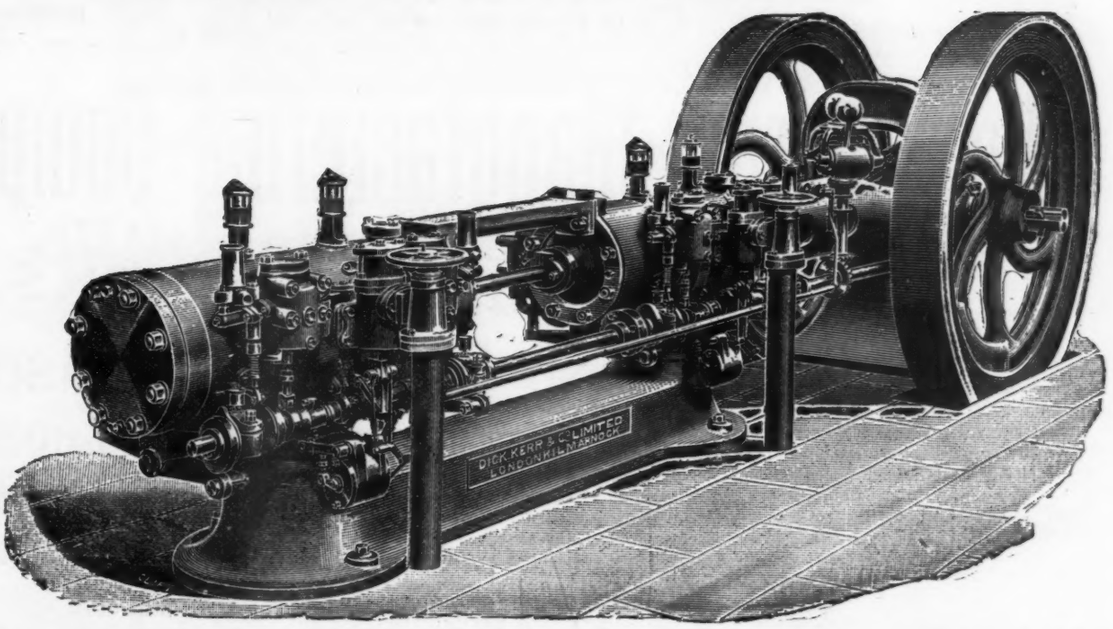

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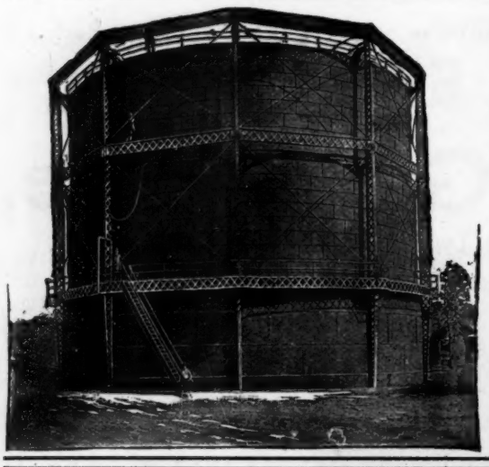

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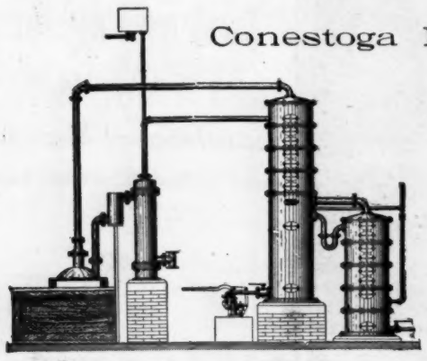

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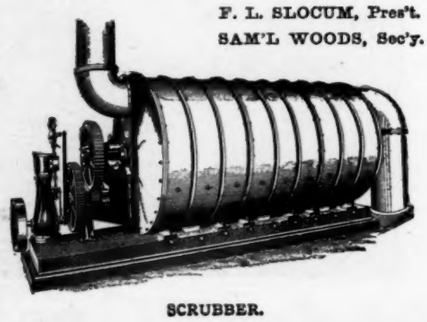

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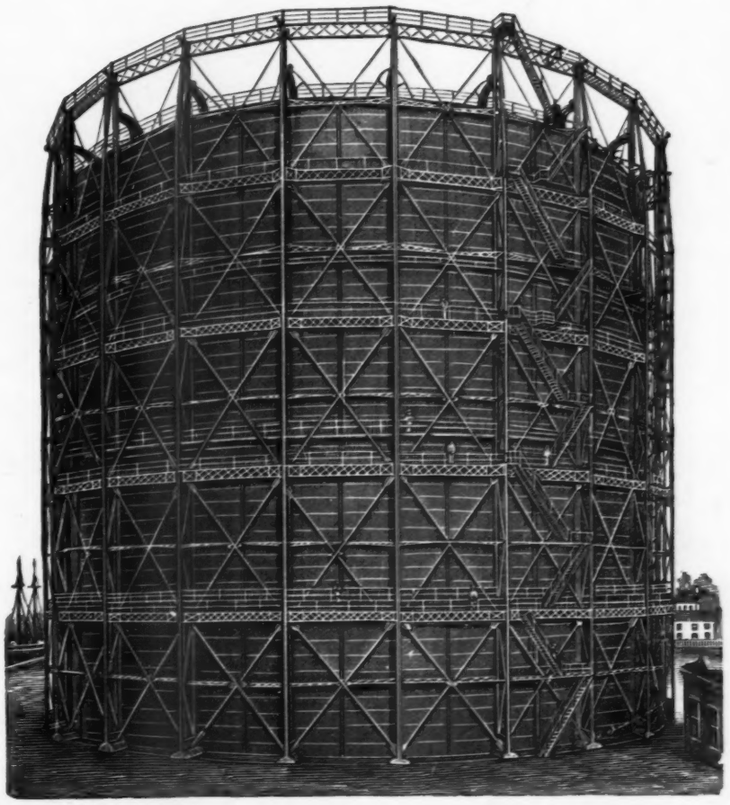

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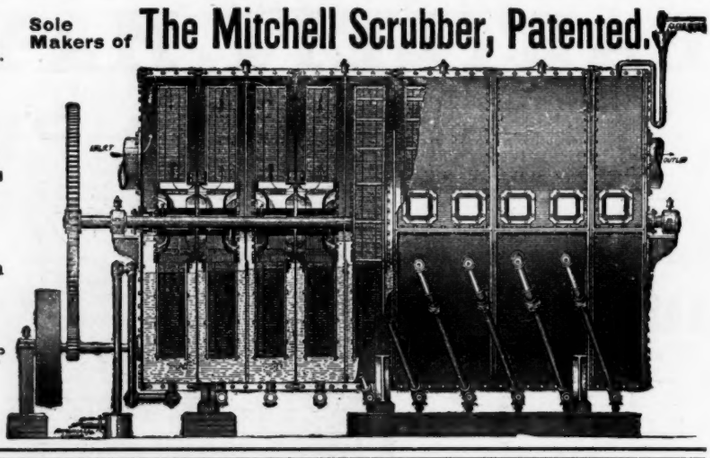

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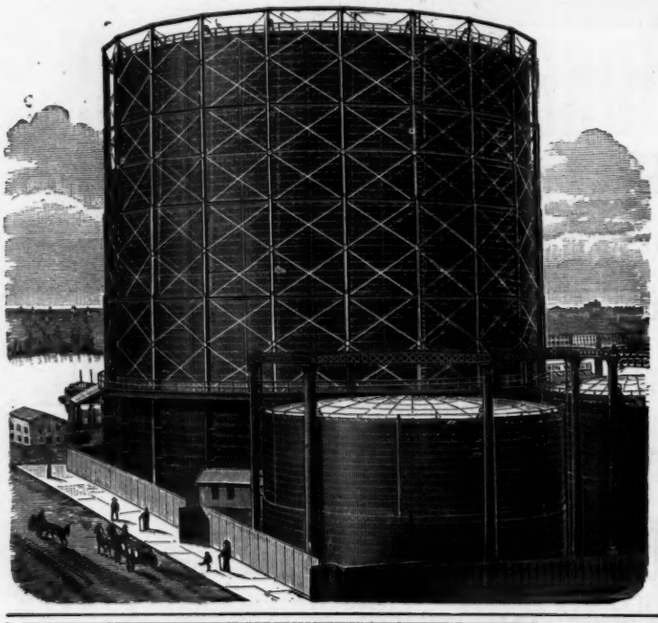

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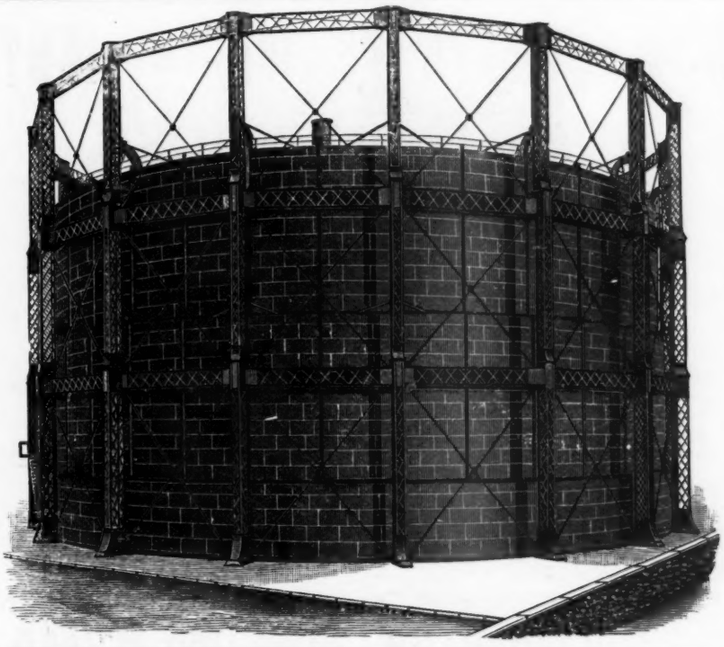

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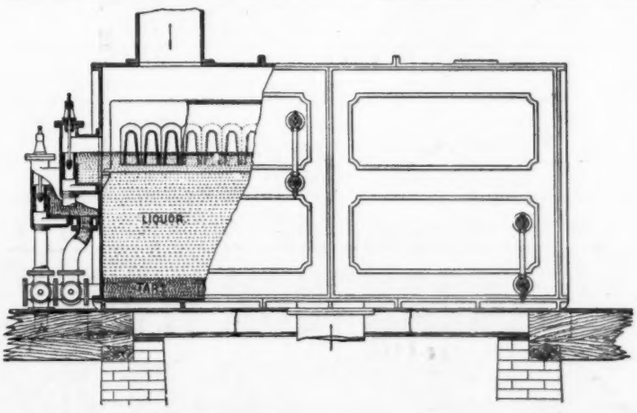

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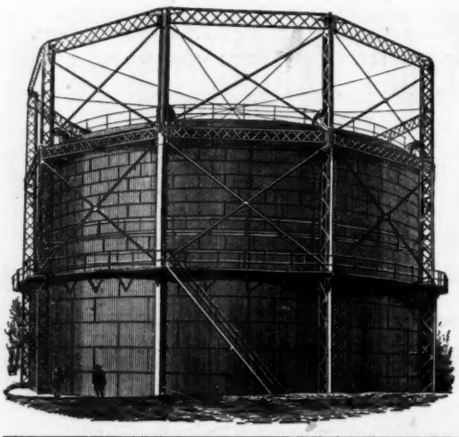

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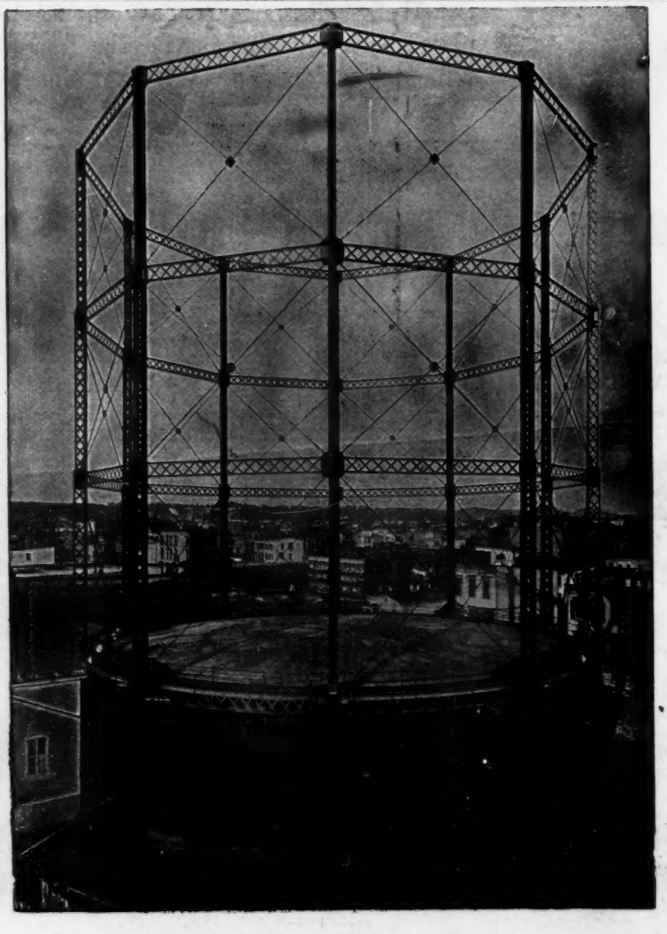

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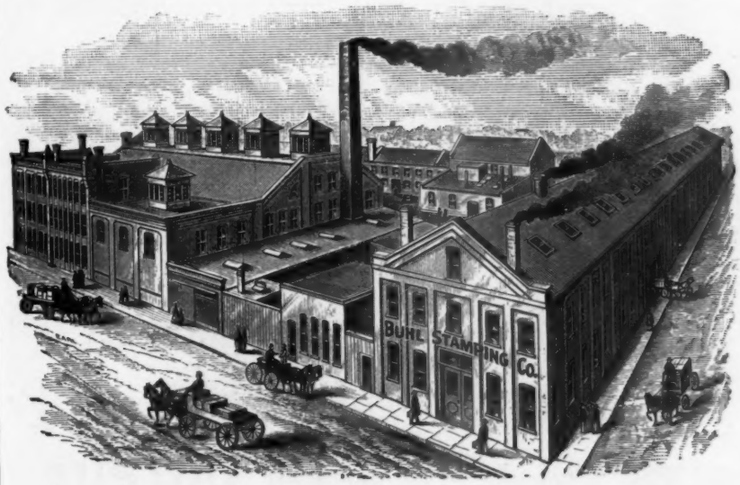

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